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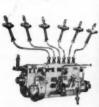












Freyn Design th Clark Control

Here's a Freyn-Design Pressure Burner installation in a Southern Steel Mill.

These burners are designed to use blast furnace gas in hot blast stoves, which, in turn, heat the air for the blast furnace. Gas is delivered to the nozzle which conducts it to the hot blast stove, after a motor-driven Vano blower forces air into the central portion of the nozzle for supporting combustion of the gas. A variable speed motor controls the required volume of air for the gas available.

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Clark "3C" controls meet these and other exacting demands in all lines of industry. Precision in rugged construction — tested materials — modern engineering — careful supervision — high standards of workmanship — all contribute toward making "3C" control apparatus give dependable service for consistent continuous production.

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Reg. U. S. Pat. Off. Published Weekly

Volume 77

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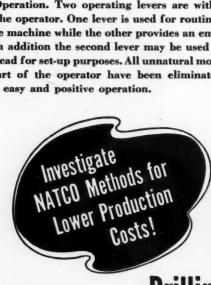
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Product Well Received at Show

But Industry Feels It Must Wait for Country-Wide Sales Report to Get Good Line on Demand for New Cars

Automobile manufacturers were favorably impressed by the public's reaction to their 1938 products at the opening of the New York Automobile Show, Oct. 27. But the show, this year, has less value as a barometer of sales possibilities than formerly because of the depression sentiment that pervades New York, probably more than any other city in the country. Not until delivery figures are in for the first reporting period in November will the industry have any reliable test of demand for its new product.

Whatever the potentialities of the retail market, motor vehicle production, however, should continue to climb to the end of the year. Barring labor troubles, output in the final quarter of 1937 stands a good chance of beating the 1,154,806-unit volume for the last quarter of 1936, even if demand should fail to measure up to expectations.

The Ford Motor Co. will be just coming into volume production in November and will need to operate full tilt to the end of the year to stock dealers and to meet the initial demand for the new lines. There probably will be no adjustment of schedules to market requirements by other companies until well into December, so that November is likely to be a big month, regardless of the sales trend. The outlook now is for fully as heavy an output as in November last year when 405,799 units were built. Any curtailment that might come will effect the December total and is not expected to run to such an extent as to wipe out the margin the current quarter already has over the corresponding period of 1936.

October piled up a lead of an esti-

October piled up a lead of an estimated 120,000 units over October last year, with Ford practically out of production. The indicated total for the (Turn to page 636, please)

Duesenberg Plant Sold

Marmon-Herrington Buys Auburn Unit's Factory

Purchase of the factory buildings and the 16-acre tract of Duesenberg, Inc., at Indianapolis, Ind., for use as the new plant of the Marmon-Herrington Co., Inc., was announced by Walter

C. Marmon, chairman of the latter's board of directors. Marmon-Herrington, manufacturers of all-wheel-drive trucks and special vehicles, will move from its present location in the old Nordyke-Marmon plant in the same city and plans to be in full production in the new quarters by Dec. 1. There will be no interruption of operations during the removal period. Marmon-Herrington acquired machinery and equipment but no jigs and fixtures.

The Duesenberg company is a division of the Auburn Automobile Co., which is controlled by the Cord Corp. Sources close to the new management

(Turn to page 636, please)

Car Prices Announced

Ford, Graham, Studebaker, Plymouth Revision Given

The Ford Motor Co. announced prices on its 1938 models which show increases over like 1937 model prices after the August increases. A factor in the prices for 1938 is the elimination of sedans without trunks, all sedan prices, therefore, comparing only with trunk sedans for 1937. The increases run to a maximum of \$36 over late 1937 prices, new prices including equipment but not Federal or State taxes or transportation charges.

(Turn to page 633, please)

Union Peace Conferences Split on Terms

The three-day AFL-CIO peace conferences in Washington broke up in disagreement on Oct. 27. Each side submitted proposals to bury the hatchet and unite. And each side flatly rejected the proposals of the other. They did not however, permanently split in peace negotiations but recessed for a week. The apparently adamant stand of the rival unions now indicates that the conferences may collapse and be followed by further bitter warfare on the labor front. The Administration is apparently making "backstage" efforts to secure a reunion.

The negotiations were undertaken between a 10-man CIO and a three-man AFL committee, the former headed by Philip Murray and the latter by George M. Howard.

The rock on which the conference has stalled is the right to organize mass industries on an industrial basis without reservation, as demanded by the CIO. It insisted upon a free hand to organize the automotive, steel and other mass industries on its own vertical lines. The nearest concession granted by the AFL was that the rebel CIO unions which were originally chartered by the AFL reunite with the latter and that an "aggressive organizing campaign be carried on by such reunited combine along both industrial and craft lines." The United Automobile Workers is one of 12 such unions.

GM Profit in Quarter Tops 1936

Earns 99 Cents a Share; Social Security 1938 Cost Put at \$10 to \$12 per Car; Sloan Sees Further Recovery

General Motors Corp. reported net income for the third quarter of the year of \$44,412,734, equal, after preferred dividend requirements, to 99c. a share on the common stock. The earnings included the company's share of the undistributed profits or losses of subsidiaries not consolidated. The statement compared with that for the like period of the previous year showing net income of \$34,626,078 or 75c. per share on the common stock. The company got little benefit in the third quarter from higher prices.

Net sales, excluding inter-divisional sales, were \$375,510,034 against \$261,-233,445 for the 1936 period. Car unit sales were 497,008 against 345,924 last year.

A cost item, not previously detailed by GM, applicable during 1938, was reported by Alfred P. Sloan, Jr., chairman of the board. He said that the cost of compliance with the Social Security Act in 1938 will be about \$18,000,000 or about \$10 to \$12 per car, all other things being equal. This is the cost (Turn to page 632, please)



NEWEST addition to the Cadillac line. It is one of four body types known as the Cadillac series, designed to accompany the 60 Special which has a specially designed touring sedan body. The four models are coupe and convertible

coupe, convertible sedan and the four door sedan shown. Announcement was to have been delayed until later in the year as production will not begin for some weeks. Wheelbase is 124 in. against 127 in. for the 60 Special. Engine is a V-8 of 135 hp.

Akron Tire Output Dips

Inventory-taking closed two of Akron's three major tire and rubber goods factories for several days during the week of October 25. Firestone Tire & Rubber Co., which is taking its yearend inventory, closed Plant No. 1 for three days and Plant No. 2 for the entire week. Goodyear closed its Plant No. 1 on October 28 for the week-end, and Plant No. 2 from Oct. 29 to Nov. 10. The inventory shutdown affects more than 20,000 employes of the two companies.

Tire production trends in the Akron area continue downward, with major manufacturers still reducing working staffs. Goodyear, Goodrich and Firestone, which supply the bulk of the original equipment tire market, are understood to be manufacturing original equipment tires almost entirely in their new subsidiary plants outside of Akron. Heretofore the bulk of this production has been handled in Akron.

Goodyear has completed its layoff of 1700 newer employes, which was approved by the Goodyear local CIO unit several weeks ago in preference to a continued share-the-work program.

Foreign Car Men Here

Among the European automotive manufacturing executives who have arrived to attend the New York Automobile Show are J. F. MacEvoy, designer of the Talbot-Royal, Paris, on exhibit at the show; R. T. Hinchliffe, material controller, and F. Grimshaw, planning controller, Leyland Motors, Ltd., England; and Fritz Hengehold and Curt Leibiger, of Arthur Hecker, Dresden automotive parts manufacturer.

APEM Indexes Rise

The Automotive Parts & Equipment Manufacturers, Inc., reports that its 40-hour employment index for the four weeks ended Sept. 18 stood at 118 against 112.5 for the preceding four weeks and against 93.9 a year earlier. The index compares with monthly averages for 1929. The 40-hour production index went to 81.4 from 76.1

against 64 for the period in 1936. Average hours per week went up to 34.9 from 34.3 against 34.5 a year earlier. Average weekly earnings rose to \$30.09 against \$29.94 and against \$24.66 a year before.

Assails Capital Curb

O'Neil Sees Changed Tax Laws Essential Now

Strikes by capital, large and small explain the reason for the present uncertainty in business in America, according to Wm. O'Neil, president of the General Tire & Rubber Company of Akron, Ohio, who states that it is necessary to restore confidence in the capital markets before it will be possible to have expansion in all lines of business to replace normal business mortalities.

"The very large capitalist is on a strike because he is faced with an 80 per cent tax on his profits on stocks, which is not subject to deduction for subsequent losses. He won't risk financing new ventures if the government's take is greater than that of the average gambling house. And he knows he will never get it back.

"The small-time capitalist, who has stayed away from Wall Street and cor-

poration finance, is on strike, too. He won't build the house that he needs—and there are many thousands like him in the United States—because labor agitation, particularly in the best-paid industries, makes costs, building conditions, and the permanence of industrial operations so uncertain. Labor trouble will be found to be greatest where the pay is highest and where housing is needed worst.

"There is a widespread move under way now toward the decentralization of industry, and capitalists, large and small, are afraid to build because they are afraid that industry will move and decentralize.

"Private building should be the biggest industry and it should employ the most labor. Government projects are always maintained on borrowed money. However, people won't build homes unless they are sure they are going to live in them, and they won't build to rent to others unless they are sure they will stay. No wonder the automobile business is good, for it provides a means to move from one place to another.

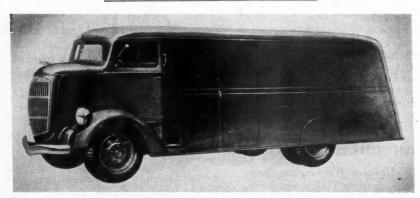
"Because the private building industry is lagging, we have a surplus of labor. This surplus is being pushed into the going industries, and the old-time employe, entitled to full hours in an industry that is busy, is being forced to share his hours. He won't build; he can't afford to. The Lewis unions welcome additional members, which means more dues. The newcomers are the most enthusiastic members, but the old employe's one privilege of steady employment is seriously threatened.

"When both large and small capital is on strike, a sensible stock-taking of the causes that have brought about this condition should lead to eradication of

(Turn to page 658, please)

"Motor Truck Facts" Issued

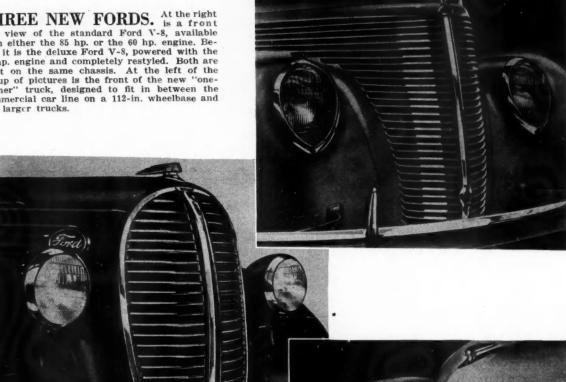
The 1937 edition of "Motor Truck Facts" has been published by the Automobile Manufacturers Association. The booklet contains complete statistics of production, sales, sales by sizes and types, exports, truck use data, lists of fleets, state regulations and other information.



REO cab-over-engine model now in production. Transmission control is direct and particular attention has been paid to accessibility for servicing. Wheelbases are 105 in., 125 in., 147 in. and 166 in. Reo Gold

Crown engines are used, one of 228 cu. in. piston displacement in the model with a gross rating of 12,000 lb. and one of 268 cu. in. piston displacement in the model with a gross rating of 15,000 lb.

THREE NEW FORDS. At the right is a front end view of the standard Ford V-8, available with either the 85 hp. or the 60 hp. engine. Below it is the deluxe Ford V-8, powered with the 85 hp. engine and completely restyled. Both are So he negine and completely restyled. Both are built on the same chassis. At the left of the group of pictures is the front of the new "one-tonner" truck, designed to fit in between the commercial car line on a 112-in. wheelbase and the larger trucks.



Ford Line Announced

2 New Cars on Same Chassis, New Truck Shown

Two new Ford cars for 1938, differing in appearance, were announced at an advance showing in the East on Oct. 27 at the company's New York show-

The cars are built on the same chassis in deluxe and standard types. The eight deluxe models are available only with the 85 hp. V-8 engine, while the three standard models have either the 85 hp. or the 60 hp. V-8 engine.

Differences between the cars, other than the engines, involve appearance, appointments and price. The deluxe models are entirely new in appearance, featuring a new radiator grille, longer hood, new fenders and more room and luggage space in closed sedans. standard models too, are restyled and have more room in the bodies.

There was presented in addition a new group of "one-tonner" trucks. available with either engine, designed to fall between the 112-in. commercial car line and the larger trucks. There is also a new 134-in. wheelbase truck, replacing the 1311/2-in. wheelbase and a 157-in. wheelbase truck. Frames on the larger models are wider, and brakes and steering have been improved.

Ford Operating in Spain

The Ford Motor Co. plant in Barcelona, Spain, is still operating, as it has been since the start of the civil war, Sir Percival Percy, chairman of the Ford Motor Co., Ltd., said on his recent arrival in Montreal. He explained that the Committee of Anarchy took over the Barcelona plant at the outbreak of hostilities, as it did everything else in the city, but Ford officials still operated the factory and production continues.

Sir Percival was accompanied by Dr. Heinrich Albert, chairman of the Ford Motor Company of Germany. They left for Detroit.

Farley Still Silent

Postmaster General James A. Farley arrived in Buffalo Oct. 25 for a conclave of western New York Democrats and declared "I've nothing to say and absolutely will not discuss the matter" when queried about his reported election as president of Pierce-Arrow Motor Corp. He also declined to discuss reports he has already leased a home in that city.



HAROLD H. UTSCHIG has been appointed national used car sales manager for Oldsmobile.

REUBEN GILL, vice-president in charge

REUBEN GILL, vice-president in charge of production;
R. M. WEBSTER, tool engineer;
J. R. BRADY, factory manager;
H. E. CRIST, chief inspector; and
G. S. MARTIN, purchasing agent, are among the new executives of the American Bantam Car Co.

HARDING MOTT, former special assistant to W. E. Holler, Chevrolet general sales manager, has been named coordinator of Chevrolet's committee system of opera-tion. He will work with dealers in their regular conferences on Chevrolet manufacturing and merchandising policies.

L. W. HULLY has been promoted by International Harvester Co. to direct national activities of the barter goods department.



MORE STREAMLINED

than ever before is this "70" Row Crop tractor made by the Hart-Parr division of the Oliver Farm Equipment Co. Styling and many of its mechanical features are patterned upon automobile practice, and so is

the manner of its announcement. The tractor was shown simultaneously in all the 48 states on Oct. 15 and the announcement period will run to Dec. The engine is a high-compression six (there is one for gasoline and one for kerosene or distillate), and there are a self-starter and electric lights.

GM Profit Tops 1936

(Continued from page 629)

on GM operations alone and, said Mr. Sloan, "Irrespective of how desirable it may be to provide unemployment insurance and old age security . . . if we have these things they must be paid for by the consumer." The reason for the burden upon the consumer and not absorption of the cost by the company was given by Mr. Sloan. He remarked that, "Whatever might be said as to what constitutes a reasonable return, attention is called to the fact that such a profit be maintained so as to permit the rapid capitalization of our constantly advancing technology, for in no other way can goods and services be produced and sold at lower real selling prices and employment stimulated."

Sees Further Recovery

Mr. Sloan said he felt that under the circumstances of today's uncertainties, a statement on the future was in order, and he summed it up by saying, "The recovery movement is not yet completed, fundamentally considered." But he added that the problem now is one of the fundamental outlooks against the existing counteracting forces, in which he included the governmental attitude toward business, "questionable" economic policies and increasing taxes. The pace of recovery is likely to be slower from now on, he admitted.

Mr. Sloan reported that for the third quarter wages and salaries disbursed amounted to \$117,719,411, an increase of 49 per cent over the total for the third quarter of last year. For nine months the total was \$348,839,967, an increase of 32 per cent. The average number of factory workers for the period was 207,958 against 158,944. The average number of employees in all categories for the quarter was 257,112 against 200,924 a year ago, an increase of 28 per cent.

The average hourly rate for all domestic workers in that group was 93 cents against 74 cents a year ago, an increase of 26 per cent, and the average weekly earnings for hourly workers was \$35.05 against \$29.01 a year ago, an increase of 21 per cent. Mr. Sloan said the working week has been shortened to spread the work, and added that the higher labor cost was also due in part to overtime paid as a result of stoppages.

The report showed nine months net income as \$154,958,000 or \$3.46 per common share, against \$175,198,624 or \$3.92 a share for the 1937 period.

Far from showing a run-off of inventories at the end of the quarter, the balance sheet gave \$263,845,019 as the total for that item, against \$165,847,807 a year earlier. Cash was \$182,007,115 against \$255,357,723, and security holdings were \$61,005,616 against \$29,-039,539. Total current assets were \$564,279,232 against \$491,085,123, and total current liabilities \$180,502,955 against \$154,448,733 at Sept. 30, 1936. Reserves were \$392,806,053 against \$337,635,533.

Company Earnings

Briggs Manufacturing

Reported net income for the September quarter of \$1,886,640 or 95 cents a share, compared with \$1,993,146 or \$1.01 a share in the third quarter of last year.

Allis-Chalmers
Reported net income for the third quarter of \$2,644,588 or \$1.49 a share, against \$1,-492,212 or 96 cents a share on a smaller number of common shares outstanding a year ago. Billings for the quarter were \$24,209,497 against \$16,750,007 in the 1936 period.

Doebler Die Casting
Reported net income for the nine months
ended Sept. 30 of \$936,209 or \$3.34 a share,
against \$710,552 last year or \$2.99 per common share on the then capitalization which included preferred shares now retired, and a smaller number of common shares.

Houdaille-Hershey

Reported net income for the nine months ended Sept. 30 of \$1,744,292 or \$1.81 a share on the class B stock after class A dividend

requirements. This compared with \$1,966,-573 or \$2.09 per class B share for the like period last year.

Reported net income for the September quarter of \$3,655,509 or \$1.91 per common quarter of \$3,005,009 or \$1.91 per common share after preferred dividend provisions, against \$3,355,625 or \$1.77 a share for the like portion of last year. Gross purchases of receivables were \$230,191,149 against \$188.527.099 last year.

Bendix Aviation Reported net income for the third quarter of \$279,207 or 13 cents a share, against \$267,-310 or 12 cents a share for the 1937 quarter

Checker Cab Manufacturing

Reported a net loss for the September quarter of \$74,555 against net income of \$62,201 or 57 cents a share in the like quarter

Stewart-Warner

Reported for the third quarter net income of \$542,625 or 43 cents a share, against \$469,-795 or 37 cents a share last year.

Eaton Manufacturing

Reported net income for the September quarter of \$432,322 or 62 cents a share, against \$501,431 or 72 cents a share for the same quarter last year.

Federal Mogul

Reported net income for the nine months ended Sept. 30 of \$310,772 or \$1.83 a share, against \$329,010 or \$2.12 a share on a smaller number of shares for the like period of last

Worthington Pump and Machinery
Report net income for the September
quarter of \$501,300 or \$2.08 per common
share, after preferred dividend requirements, against \$330,023 or 76 cents a share for the 1936 period.

Campbell, Wyant & Cannon Foundry Reported net income for the nine months ended Sept. 30 of \$849,490 or \$2.44 a share, against \$700,480 or \$2.01 a share for the like 1936 period.

Micromatic Hone
Reported net income for the first nine
months of the year of \$45,949 or 46 cents a
share, against \$25,977 or 26 cents a share
for the like portion of 1936.

Murray Corp. of America Reported net income for the September quarter of \$173,135 or 18 cents a share, against \$80,675 or 9 cents a share on a smaller amount of stock in the third quarter

Twin Coach Reported net income for the third quarter of \$132,239 or 28 cents a share against \$246,-731 or 52 cents a share for the third quarter of last year.

Packard Reports

Packard Motor Car Co. reported net income for the first nine months of the year of \$1,494,205 or 10c. a share, against \$3,562,918 or 23c. a share for the like part of 1936. For the third quarter the company had a net loss of \$2,324,862, attributed largely to the cost of model changes, against a net profit of \$42,791 in the like quarter of 1936. Expenditures for plant improvements in the third quarter were \$1,762,-945. The plant is now operating at close to capacity, it was stated.

20,000 Coast Flights

United Air Lines completed the 20,-000th coast-to-coast passenger plane trip on its Mid-Continent airway, on Oct. 28.

The first coast-to-coast passenger schedule in 1927 was provided by a connecting service at Chicago by Boeing Air Transport and National Air Transport which were merged into United Air Lines. That schedule was flown with a single-engined mail plane car-

rying two passengers.

e

United's first transcontinental flight required thirty-three hours and fourteen refueling stops. The fare was 15 cents a mile. The mileage flown on the passenger flight ten years ago was approximately 100 miles longer than today's mileage of 2633 miles from New York to the Pacific Coast, the shortening of the trip due to the route having been straightened out approximately 100 miles with the installation of modern air navigation aids. During the first year of coast-to-coast operation United carried 1697 passengers.

Prices

(Continued from page 629)

The Plymouth division of the Chrysler Corp. announced a revised list of prices on its deluxe models, the change involving a reduction from the first published prices on the cars for 1938.

There is no change in Pierce-Arrow prices for 1938.

Following are price schedules as announced with comparisons where models are not so changed as to prevent it:

Plymouth

Factory revision of DeLuxe Plymouth prices as published in Automotive Industries, Oct. 23. The Business Plymouth remains the same.

	1920	1937
DeLuxe	Prices	Prices
Coupe	. \$730	\$650
Coupe, rumble seat	. 770	700
Conv. coupe	. 850	830
Sedan, 2d	. 773	715
Sedan, 4d	. 803	745
Tour, sedan, 2d	. 785	725
Tour. sedan, 4d	. 815	755
Sedan, 7p	. 1005	995
Sedan, limousine	. 1095	1095

Graham

Delivered at factory, including equipment and federal tax.

															1938*
Stane	dard														Prices
Comb.	coupe														\$1045
Coupe															995
Sedan,	4d.**									*					1065
Speci	ial														
Comb.	coupe														1135
Coupe															1095
Sedan,	4d.**														1155

Sees Weaknesses in Union

Knudsen Holds Industrial Unit Expedient but Difficult to Hold Together; Wants Capital-Labor Gulf Narrowed

Industrial unionism has certain inherent dangers which may work out badly for the union itself, declared William S. Knudsen, president of the General Motors Corp., addressing the Associated Industries of Massachusetts

in Boston, Oct. 28.

From the standpoint of organizing it is expedient and lucrative, but to say that a toolmaker or first-class grinder should concern himself with the plight of his union brother who is pushing a truck, is taking a pretty general viewpoint," said Mr. Knudsen. "This is one of the dangers as far as strikes are concerned. A strike binds everybody in the shop to take up the dispute of somebody they are not at all interested in, with the result that the union officials have to hastily dig up enough grievances for everybody in order to hold the strike together, regardless of whether conditions in nine-tenths of the plant are satisfactory.

"On the other hand," he said, "it also is dangerous to the union because the worker is generally hard-headed enough to size up the dispute from his own standpoint and objects to losing time if

he gains nothing thereby."

Reviewing the history of the recent labor movement, Mr. Knudsen com-

mented on union tactics during the period of sitdown strikes, saying: "The direct action which followed the split in the union ranks late in 1936 and in the early part of 1937 was unnecessary and expensive. The organization which sponsored it had a previous strong and nasty strike record. It was unwilling to await the confirmation of the Wagner Act by the Supreme Court, and took matters in its own hands through fear that the act might be proclaimed unconstitutional. We had the spectacle of Government officials being fearful of taking a stand on the sitdown feature of the strike, and, with that, a general breakdown of law for a period of six months."

Mr. Knudsen said he hoped that some way would be found to arrest the class movement before it becomes so strong that nothing can stop it. He said that our standard of living has been obtained by narrowing the gulf between capital and labor, and that to widen the gulf will lower the standard. Taxation of capital, he charged, is just reaching the point where it is but a few steps ahead of confiscation, and "we all know what that means." He added, "You know we cannot grow corn

by killing the farmer."

Supe	rcharg	le	2	•													
Comb.	coupe																1270
Coupe																	1230
Sedan,	4d.**						,										1290
	om-Su																
Comb.	coupe											×					1360
Coupe																	1320
Sedan,	4d.**												*				1380

* Models not comparable with 1937.

** All sedans have built-in trunks.

Bantam

	Deliv	e	r	e	d	a	t	В	t	1	ti	e	T]	2	a				
																				1938
																			1	Price
Pick-up	truck																			\$465
Panel tr																				
Business																				
Standard																				
Roadster																				479

Ford

Delivered prices at Dearborn, Mich., but do not include federal or state taxes or transportation charges.

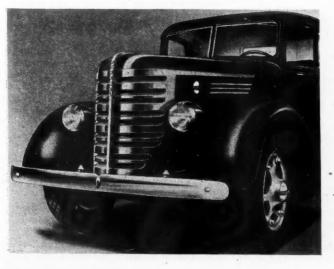
	1938	1937
V8-60	Prices	Prices
Tudor sedan*	 . \$640	\$604
Fordor sedan*	 . 685	664
Coupe	 . 595	529
V8-85		
Standard		
Tudor sedan*	 . 665	635
Fordor sedan*	 . 710	695
Coupe	 . 625	585
De Luxe		
Tudor sedan*	 . 725	698
Fordor sedan*	 . 770	758
Coupe	 . 685	658
Club coupe	 . 745	718
Convertible coupe	 . 770	718
Conv. club coupe	 . 800	758
Phaeton	 . 820	748
Convertible sedan*	 . 900	858

*All sedans carry trunks and comparisons are therefore mad^ with trunk sedans.

Studebaker

Delivered at the Factory

Denvered at the Factory.	
	1938
Six	Prices
Business coupe, 3p	. \$895
Custom coupe, 3p	. 920
Club sedan	. 985
Cruising sedan	. 995
Conv. sedan	. 1345
Custom coupe, 3p	. 965
Club sedan	. 1030
Cruising sedan	. 1040
Conv. sedan	. 1390
Custom coupe	. 1120
Club sedan	. 1185
Cruising sedan	. 1195
Conv. sedan	. 1555



FEDERAL

truck styling, by Henry Dreyfuss, for 1938. There is a line of twelve new models ranging from ¾ to 5 tons capacity. Five-speed transmissions are standard on models of 3 to 4½-ton capacity and can be secured on the 1½ to 2½-ton models have four-speed transmissions.

Business in Brief

Written by the Guaranty Trust Co., New York

Business Activity Dips

General business activity declined during the week ended October 16. The weekly business index compiled by the "Journal of Commerce" stood at 99.9, as compared with 100.7 the week before and 101.2 for the corresponding period last year. The current figure represents the first occasion when the index was below that a year earlier since the expansion commenced. Retail sales were from 1 to 3 per cent above those in the preceding week and from 4 to 12 per cent above those in the corresponding period last

The index of business activity com-piled by the Guaranty Trust Co. for September stood at the preliminary fig-ure of 94.2, as compared with 96.1 the month before and 88.2 a year ago. The company's index of wholesale commodity prices for October 15 was 77.9, as compared with 85.8 a month earlier and 73.9 a year earlier.

Car Loadings Drop

Railway freight loadings during the week ended October 16 totaled 809,944 cars, which marks a decrease of 5178 cars below those in the preceding week, a drop of 16.581 cars below those a year ago, and a rise of 86,640 cars above those two years ago.

A recent report issued by the Depart-ment of Labor discloses that the level of employment increased by 43,000 workers during August in manufacturing and non-manufacturing industries. Weekly payrolls of the industries included in the survey increased \$8,400,000. There were 1.100.000 more workers in employment in August than in the corresponding period last year.

Lumber production during the week ended October 9 stood at 67 per cent of the 1929 weekly average. The level of output was 23 per cent above new and 14 per cent heavier than shipments. Reported production, new orders, and shipments were all below the figures for the preceding week.

Fisher Index Eases

Professor Fisher's index of wholesale commodity prices for the week ended October 23 stood at 89.3, as compared with 89.5 the week before and 89.8 two weeks before.

consolidated statement The Federal Reserve banks for the we ended October 20 showed a decline \$5,000,000 in holdings of discounted bills. Bills bought in the open market and securities remained Government changed. Money in circulation declined \$39,000,000, while the monetary gold stock increased \$9,000,000.

being closely watched by buyers. The market was a shade higher on Tuesday.

Another break in copper prices at London on Monday caused some custom smelters to mark down their price to 11% cents, but the generally quoted level is 12 cents, with some producers maintaining nominally their 13-cent quotation. Some of the large producers feel that price reductions would not result in any increased buying at this time.

Lead turned dull as the result of offish-ness of buyers when London cabled another ness of ouyers when London cabled another sharp dip in prices, but quotations are nominally unchanged. Zinc prices have been lowered ¼ of a cent to 5% cents, East St. Louis, the lowest price in nine months.

—W. C. H.

Buffalo Rate Down

Bethlehem Steel's big Lackawanna strip mill near Buffalo was shut down completely for five days during the week ended Oct. 23 when the unit caught up with orders from General Motors, Chrysler and other car makers. The mill now is back in production, however, operating near capacity

Bethlehem, Republic and Wickwire, the three firms operating here, are dependent to a large extent on orders from the auto-motive industries. While these orders have been appearing in fair volume, buying is far below a year ago and not of sufficient volume to maintain the high steel rate here, mill heads reported.

New Broadcast

The Chrysler Corp. is sponsoring a new series of sports talks titled "Chrysler Football Parade with Frank G. Menke." The program is broadcast over WABC every Friday from 7:15 to 7:30 p.m., EST.

Automotive Metal Markets

Steel Works Adjusting Operations as Product Movement Is Described as "Fair": Tin Prices Still Erratic

Calmer minds in the steel market do not look upon this week's decline in the operating rate of 52.1 per cent of theoretical ingot capacity as denoting anything more than a temporary adjustment of primary output to reserves of finishing departments and independent finishing mills.

Much in the way of gloomy steel market news emanates from Pittsburgh, where working schedules have been more sharply cut than in any of the other steel-making districts. some areas, for instance Detroit, finishing mills continue to operate at a relatively fair rate. Decidedly encouraging are reports that cold-finishing mills are enjoying better inquiry. movement of automobile sheets, while by no means spectacular, is of fair routine proportions. Hot and cold rolled strip steel is being bought as needed, making perhaps for somewhat more spotty conditions than usual, but on the whole permitting mills to continue operating on a temporarily curtailed time basis. Some producers appear to be in much better shape than others, making for negligible lay-offs in some mills while in others the layoffs run rather high.

Just how much has been added to the cost of a ton of steel by the increase in freight rates on bituminous coal, coke, iron ore, scrap iron and steel and minor steel-making materials has not yet been definitely ascertained. It is thought that base prices will not come in for any change at this time. When the leading steel producing interest re-

cently reaffirmed prevailing prices for first quarter of 1938 shipments, it was with the annotation: "Subject to any change in freight rates at the time of shipment." For the current quarter, however, consumers assume that prices will remain as they are, and while quite a few announcements of unchanged prices for this and that description of finished steel for the next quarter have been made in the last few days, consumers are giving little thought to 1938 buying programs.

Just what the International Tin Committee has up its sleeve in announcing, this week, that it favors a reduction in the tin export quota from the present 110 per cent of standard tonnages to 85 per cent for the January-March quarter of 1938, is one of the many puzzles with which purchasing agents have to wrestle. In the tin market the opinion was advanced that the committee's objective is to keep producing countries that have been exporting less than their respective quotas from trying to make up this shortage during the last quarter of the year in the expectation that they will get much higher prices next year. Then there is also the possibility that, confronted with the threat of so sharp a cut in output, consumers may be prompted to buy tin now and, with speculators following suit, this would result in a rising market. Prices opened this week at 48%c. for spot Straits, 1%c. below the preceding close and the low for the year. Certain it is that the tin market is in for more pyrotechnics and it is

. . . slants

SHOW- HIGHLIGHTS-At Detroit's first automobile show in 1902, reports Cadillac, which produced its first car in that year, an exhibition of the taxidermist's art shared the spotlight with the gas, steam and electric vehicles that were exhibited. Opening night at the show drew 1600 people. Newspaper reporters noted as present "a sprinkling of Detroit society." It was also remarked that manufacturers were already beginning to direct car design toward catching the attention of the feminine contingent. It was about the same time that automobile advertising featured the advantages of the automobile against the horse by stating that an automobile would "never eat its head off" and that there was no "hitching or unhitching annoyance."

RIPLEY ABROAD-The British magazine, "Motor Trader," offers this one under the somehow-familiar head, "Believe It or Not": W. Eayre, a butcher of St. Neots (Hunts), on his way from St. Neots to Huntingdon, found his car showing unmistakable signs of needing petrol. As luck would have it, the car came gently to rest outside a garage. "Strange," said Mr. Eayre to himself, "I thought I had plenty of petrol." To the garage attendant he said, "Ten gallons, please. The tank's at the back of the car." Not finding the tank there, the youth started opening the bonnet. "What's the matter?" asked Mr. Eayres. "I'm looking for the tank," re-plied the attendant. "Didn't I tell you it was in the back?" said Mr. Eayres, getting out of the car. But it wasn't. It had fallen off a mile or so after Mr. Eayres had left home, and a man had found it with nearly ten gallons of petrol in it lying on the road. The car had gone several miles on the petrol in the Autovac.

DETAILS-The extent to which car manufacturers go in providing details which are bound to appeal to somebody is shown in a show story by a body producer. His luggage compartments are provided with a place where a small nail or bolt can be inserted to lock the catch open in case the owner wants to drive with the lid open, carrying hunting dogs or assuring room for moving household belongings from one house to another. Another angle, which makes for cleaner windshields, is provision for the playing of a stream of water on the outside of the glass through the wiper transmission. Presumably, this would be very useful in dusty or "buggy" country.

GM Overseas Sales Up

Sales of General Motors cars and trucks to dralers in the overseas markets during September totaled 30,109 units, representing an increase of 27 per cent over the volume in September of last year. In the first nine months of 1937, sales of 276,524 units represented an all-time high volume for that period, and an increase of 11.7 per cent over the volume in the first nine months of 1936. For the twelve months through September. For the twelve months through September, 1937, sales totaled 353,643 units, an increase of 12 per cent over the volume in the twelve months ended September 30, 1936.

Declares Extra

Directors of the Stewart-Warner Corp. declared an extra dividend of 25 cents a share on the capital stock of the corporation in addition to the regular semi-annual dividend of like amount. Both are payable December 1 to stockholders of record No-

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

Foreign Notes

A company has been organized to introduce motor cabs and omnibuses into Berlin, Germany.

Experiments with motor cabs are still going on in Paris. Both electric and petroleum motors are being tested, so far without decisive results, so the cab company reports.

French regulations regarding the

The French regulations regarding the circulation of motor vehicles are becoming so complicated that those in charge of them have to carry around bulky volumes containing the law on the subject.

The second general meeting of the stockholders of the Daimler Motor Co. took place on Oct. 14. Although the balance on hand would have warranted a dividend of 10 percent the directors recommended that the cent the directors recommended that the money be expended in additional plant. A permanent exhibition of motor vehicles

is to be established at Paris in order to provide a place where visitors and intending purchasers may conveniently examine all the different makes without the loss of time required to call at the factories. Some objection may be offered by manufacturers if they are expected to expose all the details of their system.

From The Horseless Age, Oct., 1897.

Auto-railer in Use

First regularly scheduled use of the auto-First regularly scheduled use of the autoralier, a bus which is quickly convertible into a rail car, has been begun in New Brunswick, Canada. The autoralier travels over the same roadbed as was used New Brunswick's first railway, the for New Brunswick's first railway, the European & North American, from Moncton to St. John. Time for the trip is 2 hr. 35 min. for 90 miles. When converted into a rail car the steering gear is locked in position. The auto-railer is powered with a six cylinder, gasoline, carries 23 passengers.

Urges Annual Eye Tests

Annual eyesight tests for automobile drivers have been recommended by Dr. Irving Strauss, eyesight authority of

the Motor Vehicle Bureau of New York State, as a means of reducing the number of highway accidents.

Periodic tests would eliminate the hazard that usually comes with advancing age and impaired sight, it has been shown. An eyesight test when the first license to drive is issued is no protection against the subsequent normal changes in eyesight. Age, however, is not the only element that affects the eyesight of drivers. The fatigue of many hours of steady driving, day or night, strains the eyes, causes discomfort, and creates a condition of danger in which the drivers' eyes do not focus readily.

Production Swings Upward

Passenger car and truck production for September showed a gain of 25.5 per cent over that for the same month of last year. The gain, comparing with a 14 per cent gain for nine months of the year, was doubtless due to the advanced date for the automobile shows this year.

Truck production for nine months was 11.5 per cent over the volume for the first nine

months of 1929, the previous record year.

Passenger Car and Truck Production

(U. S. and Canada)

	September	August	September	Nine Months				
	1937	1937	1936	1937	1936			
Passenger Care—U. S. and Canada: Domestic Market—U. S. Foreign Market—U. S. Canada	110,122 8,549 1,926	299,498 11,960 5,814	83,899 6,202 2,223	2,887,392 190,096 117,076	2,570,009 142,827 97,878			
Total	120,597	317,270	92,324	3,194,564	2,810,714			
Trucks—U. S. and Canada; Domestic Market—U. S. Foreign Market—U. S. Canada		64,506 18,360 4,928	37,894 7,170 2,432	566,446 149,408 44,595	522,261 100,633 27,860			
Total	55,023	87,794	47,496	760,449	650,754			
Total—Domestic Market—U. S. Total—Foreign Market—U. S. Total—Canada		364,002 30,320 10,742	121,793 13,372 4,655	3,453,838 339,504 161,671	3,092,270 243,460 125,738			
Total-Cars and Trucks-U. S. and Canada	175,620	405,064	139,820	3.955,013	3,461,468			

Passenger Car Production by Wholesale Price Classes

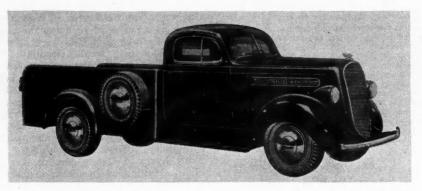
(U. S. and Canada)

	Nine N	lonths		Per Cent of Total				
	1937	1936	Per Cent Change	1937	1936			
Under \$500 . \$501 to \$750 . \$751 to \$1000 . \$1001 to \$1500 . \$1501 to \$2000 . \$2001 to \$3000 . \$3001 and over .	1,525,705 1,528,147 106,524 23,577 8,182 2,299 130	1,566,027 1,120,694 85,535 27,512 7,495 3,194 257	- 2.5 +36.3 +24.8 -14.4 + 9.2 -27.9 -49.3	47.76 47.84 3.33 .74 .26	55.72 39.87 3.04 .98 .27 .11			
Total	3,194,564	2,810,714	+13.5	100.00	100.00			

Truck Production by Capacities

(U. S. and Canada)

	Nine M	onths		Per Cent of Tot		
	1937	1936	Per Cent Change	1937	1936	
1½ Tons and less. 2 to 3 Tons. 3½ Tons and over. Special and buses.	710,616 29,867 10,289 9,677	605,670 30,439 6,217 8,429	+17.2 - 1.8 +65.9 +15.0	93.45 3.93 1.35 1.27	93.07 4.68 .96 1.29	
Total	760,449	650,754	+16.9	100.00	100.00	



FAST-TRANSPORT,

recently announced by Studebaker. It is rated as in the %- to one-ton range, is mounted on a 130-in. wheelbase and is powered with a six-cylinder 3 5/16 by 4% in. engine rated at 79 hp. Special body features are built in for driver comfort and safety such as defrosters and dome light.

Duesenberg Plant Sold

(Continued from page 629)

of the Cord Corp. have insisted that production of Auburn, Cord and Duesenberg cars will be discontinued. The property is located at the junction of the Big Four and Belt railroads in Indianapolis. There are three buildings and additions will be constructed as needed.

Plant Notes

A new building to provide additional office and laboratory facilities for the Parker Rust-Proof Co. is under construction in Detroit. The new addition, adjacent to the present building, will be a two-story fireproof structure extending 148 ft. by 152 ft. One portion of the ground floor of the new addition will be devoted to an enlarged testing and demonstration laboratory equipped with the latest precision instruments and equipment for testing and studying surfaces. The rest of the space will be devoted to a sheet metal shop and storage space for rustproofing chemicals.

Michigan Steel Tube Products Co., Detroit, has placed an order with the Austin Co., Cleveland, for the erection of two additional buildings which will provide 45,000 sq. ft. of floor space, at a cost of about \$100,000, it was announced by Charles E. Miller, president of the tube company. The company is also installing a new annealing furnace for the manufacture of normalized steel tubing.

Construction of a large, modern manufacturing building which will provide the Detroit Rex Products Co. with approximately 30,000 sq. ft. of additional floor space has been completed by the Austin Co. The increased demand for solvent degreasing machines and degreasing solvents has made this expansion program necessary, according to R. A. Emmett, president. This is the second time within the period of a year that manufacturing facilities have been enlarged.

F. M. Young, president of the Young Radiator Co., announces a number of changes in its manufacturing facilities.

Several new departments, handling a large battery of press brakes, shearing equipment, electric welders and other machinery for welding and machining, have also been established. The company has increased its floor space to almost double its former occupancy. The machine shop and sheet metal shop are now entirely self-contained and separate from the other activities.

Auto-Lite spark plugs have been adopted as standard factory equipment by Nash, Plymouth and DeSoto for 1938. To step up production to meet the demand for the spark plugs which these companies will require, and at the same time keep its dealer organization amply supplied with replacement stocks, the Electric Auto-Lite Co. is completing an expansion program which will triple the output of its spark plug plant at Fostoria, Ohio.

Tiedemann With Nash

Establishment of a new department of business management in the Nash Motors division of Nash-Kelvinator Corp. and appointment of A. Carl Tiedemann, until repointment of A. Carl Tiedemann, until recently a regional manager for the Packard Motor Car Co., as director of the new department, were announced by C. H. Bliss, vice-president and director of sales. The new department, Mr. Bliss said, will work with factory branches and distributors in applying practical business management methods to both wholesale and retail oper-

Automobile Linage

Automotive newspaper advertising linage for the year ended Oct. 1, 1937, was 69,974,847 against 70,031,124 for the preceding year, according to Editor & Publisher. September advertising linage was 4,052,187 lines against 5,-371,232 in August and against 4,256,-877 in September, 1936. Linage has fallen back in recent calendar years in spite of increased production.

Football Broadcasts

Oldsmobile will sponsor seven broad-casts of games played by the Chicago Bears, professional football team, this season.

U.S. Rubber Raises Tires

U. S. Rubber Co. announced minor increases in first, second and third line tires effective Oct. 28 with adjust-

ment for trade discounts so that manufacturer and dealer will share equally in the benefits from higher list levels.

It was reported that an emergency meeting of the British rubber restriction committee has been called for next week in London to drastically reduce the exportable quota for first quarter of next year in an effort to strengthen crude rubber prices. American manufacturers are hoping for action to bolster crude prices so they can avoid excessive inventory write downs.

Product Well Received

(Continued from page 629)

is around 350,000 vehicles month against 230,049 a year ago, reflecting the earlier start by most companies on their new model programs.

Delayed by difficulties with dies, Ford assembly of finished cars was started in a small way at the Rouge plant last week, about a week later than in 1936. Only a few thousand cars at most were expected to be run off in October. The company is now about ready to begin volume production and operations should pick up rapidly since heavy shipments of parts and subassemblies have been going forward to branches for some time. With removal of the bottle-neck on certain body dies. branch plants are due to reopen early in November.

Another factor that may make for heavy operations in the current quarter is the advisability of building up field stocks to avoid shortages of cars in the event that labor troubles interfere with operations. There is some indication that such reserve stocks will be built up. While the labor situation on the whole is far better than a year ago, the UAW threat still hangs over the Ford Motor Co., and it may prove to be good business for Ford and the balance of the industry to build ahead. -H. E. G.

Willys-Overland closed down its plant Oct. 26 due to a shortage of fenders, hoods and body stampings. Sam Black, works manager, said that the higher rate of production of the last two weeks has resulted in a shortage of these parts which flow in from other cities and usually run quite close to local requirements. Most of the parts come from Philadelphia, Detroit and Salem, Ohio he said. The company has 6000 men at work and was making about 2000 cars a week. The management hoped to recall the force in a few days.

Buick production is averaging better than

Buick production is averaging better than 1200 cars a day with a sufficient number of orders on hand to maintain capacity operation through the first of the year. Production for the week ended Oct. 15 was 6093 units. Average retail delivery figures, covering the first ten days of the month, show that 4740 new Buicks were delivered to customers in the United States, best since 1929, compared with 917 in the first ten days of October a year ago, W. F. Hufstader, general sales manager, said.

Production of Hudson cars is running higher than for any October since 1925, reports William R. Tracy, vice-president in charge of sales of the Hudson Motor Car Co. "Our shipments of 1938 cars to date are more than double that of last year up

co. "Our snipments of 1938 cars to date are more than double that of last year up to this date," reports Mr. Tracy. "For the week ended October 16, we shipped 4388 cars. This the best week of corresponding date for 12 years.

A goal of 60,000 Lincoln-Zephyr cars has been set for 1938, Edsel Ford announced at a press preview of the new models Oct. 18. This compares with about 30,000 built in 1937 model year and 15,500 in 1936, the first year these cars were on the market. Capacity of the plant has been increased to 400 cars a day from 175. Nearly two miles of additional conveyor lines have been added, making total length of the line three miles. Included in plant improvements are an air conditioning system for the body department and new enameling ovens.

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an air conditioning system for the body department and new enameling ovens.

A new all-time high sales record was established by Oldsmobile for the first 10 day period of October with the delivery at retail of 3339 Oldsmobile sixes and eights, it was announced by D. E. Ralston, general sales manager. The new sales record represents an increase of more than 163 per cent over retail deliveries in the same period of 1936, and is greater by 577 units than Oldsmobile sales during the final 10 days of last month. Total Oldsmobile sales from Jan. 1 through Oct. 10 this year have exceeded 159,000 units, Mr. Ralston stated, a peak which eclipses by a wide margin the sales recorded in any similar period of Oldsmobile history.

Micromatic, Barnes Buy Hutto

The assets and good-will of the Hutto Machine division of the Carborundum Co. have been sold to the Micromatic Hone Corp., Detroit, Mich., and the Barnes Drill Co., Rockford Ill. The business will be subdivided by the purchasers. Barnes Drill Co. will absorb that part of the business relating to the manufacture, sale and service of honing machines and gear lapping machines, and the Micromatic Hone Corp. will take over the manufacture, sale and service of honing tools and tool replacement parts. The Micromatic Hone Corp. will also carry a full line and render a complete replacement service of Carborundum brand cylinder honing stones for all customers, as well as for other lines of leading abrasive honing sticks.

The plant of the Hutto Machine division, which has been closed by a "sitdown" strike during the last five weeks, was reopened under the management and name of the Micromatic Hone Corp., Hutto division, and full operations resumed on October 25, the strike having been settled on terms favorable to the workers and the new management. No reduction of the present personnel of the Hutto division is anticipated by the new owners.

Kirke W. Connor will serve as chief executive of the combined organizations relating to honing tool manufacture. Announcement of other executive personnel appointments will be made at a later date.

Graham's \$1,000,000 Ads

Graham will spend more than \$1,000,000 to advertise its new 1938 automobiles. A large part of the funds will be expended in the next three months. National magazines and newspapers will be used in a comprehensive program to assist dealers.

Snow With Evans Products

Herbert C. Snow, formerly consulting engineer for the Auburn Automobile Co., is now director of engineering for the Evans Products Co., Detroit.



Precision Lathes

. . . South Bend machines have pedestal adjustable motor

A new design of back-geared, screw cutting, precision lathes with pedestal adjustable motor drive has been announced by the South Bend Lathe Works, South Bend, Ind. The new drive is available in the five sizes of South Bend precision lathes, 9 in, 11 in., 13 in., 15 in., and 16-in. swing. Bed lengths of these machines range upward from 3 ft. to 12 ft.

The pedestal adjustable motor drive mechanism is a separate unit with motor and countershaft mounted on a pedestal back of the lathe in a position horizontal with the headstock cone pulley of the lathe. Power is transmitted from the motor to the countershaft by vee-belts, and from the countershaft to the lathe spindle by flat leather belt.

The reversing switch is located near the lathe spindle and permits the operator to start, stop or reverse the rotation of the lathe from a convenient working position.

A turnbuckle adjustment permits adjusting the cone pulley belt for any desired pulling power and for taking up belt stretch. Easy shifting of the cone pulley belt from one step of the pulley to another is facilitated by a belt tension release lever.

According to the manufacturer, new features of the pedestal motor drive include: motor entirely apart from the lathe, thus eliminating vibration; silent belt drive providing a smooth steady pull; no overhead belts to obstruct vision or to cast shadows on the work; vee-belts from motor to pulley enclosed by a guard; screw type belt tension adjustment for any desired pulling power; and release for shifting belt to change spindle speeds.

The new line of South Bend pedestal adjustable motor driven precision lathes are also reported to have the following improvements: heat-treated headstock spindle with all bearing surfaces hardened and ground, including the taper hole; spindles of special alloy steel, with phosphor bronze bearings, line bored and lapped to a perfect bearing and adjustable for wear; new double wall apron with self-oiling steel gears, and all gear shafts supported on both ends; and a multiple disk friction clutch in the apron.

These machines are built in quick change gear and standard change gear types. The former are equipped with a quick change mechanism for cutting

48 right- and left-hand standard screw threads ranging from 2 to 112 per in., including 11½ pipe thread. Standard change gear lathes are equipped with a set of loose change gears for cutting right- and left-hand screw threads from 2 to 4 per in., including 11½ pipe thread.

Contour Machine

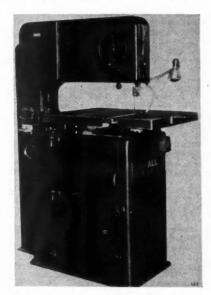
. . . with 30-in. throat capacity has built-in automatic instant butt-welder for the saws.

Important feature of the Doall contour machine with 30-in. throat capacity recently placed on the market by Continental Machine Specialties, Inc., Minneapolis, is the built-in automatic instant butt-welder for the saws.

A voltage regulator is said to make all welds exactly uniform, and the entire butt-welding operation is done automatically.

Among other elements of the equipment emphasized by the maker is the dial control of cutting speeds.

A speed indicator records the exact speed within the range from 40 to 800 ft. per min. A "job selector" dial trans-



Doall contour machine with 30-in. throat capacity

lates the correct speed to use in sawing or filing 48 different materials. Power work feed actuated by weights and levers is also incorporated into the latest design. Weight or pull is adjustable with a hand wheel. A mechanical toggle permits mechanically rotating the work to follow a contour, instead of guiding the contour by hand. Work

(Turn to page 639, please)



Equivalent-Length Formula for Crank Units

Some work on methods of calculating the equivalent length of a crank unit or crank throw, for the purpose of determin-

crank throw, for the purpose of determining the critical speeds of torsional vibration of engines, is dealt with in an article in Engineering by W. A. Tuplin, M.Sc. He defines the equivalent length of a crank throw as the length of a 1-in. solid shaft which has the same torsional rigidity as the crank throw under consideration.

Dimensional and torsion-test values were gathered for a total of seventeen crank-shafts. The author applied four existing formulae (those of Geiger, Timoshenko, Carter and Ker Wilson) to these data and then determined the correction factor with which the result of any given formula applied to the data for any given shaft must be multiplied in order to obtain the equivalent length of the shaft arrived at from torsion tests.

from torsion tests.

The chief uncertainty in all formulæ for the calculation of equivalent lengths is due to the "end effects," that is, to the effect of sudden changes in section, on the torsional stiffness. It is quite obvious that torsional stiffness. It is quite obvious that where there is an abrupt change from a larger to a smaller diameter, the material in the larger section near the shoulder is not subjected to any material torsional strain. This results in an actual increase in the equivalent length by an amount which the author designates by \(\delta\). Tentative values of 0.2 D₁ and 0.2 D₂ were assigned to the increase in the equivalent length due to the "end effects" at the junctions of the crank arms with the main journals and crankpins respectively. With these items introduced into the expressions for the equivalent lengths due to main journals and crankpins respectively, the equivalent lengths of the complete crank units were calculated and the calculated values compared with the observed ones. It was found that the discrepancies varied with the expression r/hw³, where r is the proper radius he the thickness and we the It was found that the discrepancies varied with the expression r/hw³, where r is the crank radius, h the thickness and w the width of the crank arm, the ratios in the various examples having a mean value of about 0.7. Endeavors were made also to trace a connection between the ratio of discrepancy to r/hw³ and singularities in the dimensions of the shafts. In this way it was found that variations in the ratio could be reduced by dividing the item for the main journal by $1 - \left(\frac{d_1}{D_1}\right)^4$ and the item for the crankpin by $1 - \left(\frac{d_2}{D_2}\right)^4$, and these factors were introduced into the equation for the equivalent shaft length. The equation finally arrived at is as follows:

Equivalent length of crank unit-

Limitations to the Speeds of Diesel Engines

When the operating speed of an automotive Diesel engine is increased, the excessair ratio compensates to some extent for the lowering of the mean effective pressure due to the decrease in the volumetric efficiency. However, above a certain limit the air quantity becomes deficient, and this results in incomplete combustion and in a loss in mean effective pressure. To make higher operating speeds practical, the engine must be so designed as to be able to burn fuel with a small excess-air ratio at high speeds of rotation, and at the same time the cycle must be readily applicable to service conditions.

The paper shows the relation between the maximum combustion pressure, the mean effective pressure, and the excess-air mean effective pressure, and the excess-air ratio by means of a three-coordinate diagram, which is intended to visualize the operating limits of automotive Diesel engines. The author maintains that in an engine with sufficiently high compression, such as a modern high-speed Diesel engine, for a given maximum combustion pressure the greatest mean effective pressure is obtained with a cycle that is very near to a constant-pressure cycle, and that for a given compression ratio that cycle is also given compression ratio that cycle is also

ne most serviceable.

The paper also deals with the decrease in the polytropic exponent of the compression line and with the decrease in flywheel effect at minimum operating speeds. enect at minimum operating speeds. It compares a Comet-type six-cylinder Diesel engine with a gasoline engine of substan-tially the same displacement, from this point of view, and shows that the minimum speed of view, and snows that the minimum speed at which the flywheel is able to turn the engine over against the force of compression is 234 r.p.m. for the former and 164 r.p.m. for the latter. These may be the minimum practical operating speeds for the two engines.—T. Watanabe in The Japanese Journal of Engineering.

Hillman Car Has Independent Front Springing

The new Hillman car, just announced, is fitted with independent front springing, which was developed from the system used on the Hillman Hawk. A transverse semi-eliptic spring connects the lower ends of the steering heads on opposite sides to the frome. The unpre-ends of these steering the steering heads on opposite sides to the frame. The upper ends of these steering hads are connected to the fram by wishbones located at a level above that of the frame. To reduce wear of the "wishbone" joints to a minimum, it is provided with screw-threaded pivot pins which work in threaded bushings. Spring action is controlled by double-acting hydraulic shock absorbers.—The Autocar, Sept. 3.

$$\begin{aligned} &\frac{2b + 0.15 \ D_1}{D_1^4 - d_1^4 \left[1 - \left(\frac{d_1}{D_1}\right)^4\right]} + \frac{a + 0.15 \ D_2}{\left(D_2^4 - d_2^4 \left[1 - \left(\frac{d_2}{D_2}\right)^4\right]} + \frac{2h - 0.15 \ D_1 - 0.15 \ D_2}{w^4 - d_1^4} \\ &+ \frac{r}{hw^3} \left[\frac{0.065 \ D_1}{r} + 0.58\right] + \frac{0.016}{h^2w} \end{aligned}$$

Applying the Carter formula to all seventeen shafts it was found that the correction factors ranged from 0.79 to 1.108 and the average error was 6.6. With the new formula the correction factors ranged from 0.92 to 1.088 and the average error was 4.46 per cent.—Engineering, Sept. 10.

Argentine Tire Output Up

Although official statistics are not yet available, a compilation of cargoes of incoming ships indicates that Argentine imports of crude rubber for the third quarter of this year were ex-

ceptionally heavy, according to a report to the Bureau of Foreign and Domestic Commerce by Joe D. Walstrom, American assistant trade commissioner. Buenos Aires.

Incoming ships manifests indicate that the quantity of crude rubber brought into Argentina during the first nine months of this year totaled 13,-742,060 lb. as compared with only 7,-213,470 lb. and 9,346,110 lb. during the like periods of 1936 and 1935, respectively, it was reported.

The principal reason for this higher level is the increased production activity of the local tire factories, caused not only by increased retail tire sales for replacement, but also to a heavier original equipment business resulting from the much larger number of automotive units being sold this year, the report stated.

A further factor is the desire of the local rubber manufacturing industry to build up its crude stocks in view of uncertain developments in the Far East and for these reasons it is expected that the higher level of Argentine imports will continue for the next several months, according to the report.

Dodge Trucks Announced

Dodge division of Chrysler Corp. is exhibiting its new line of commercial cars and trucks. Included are commercial cars, ¾ to one-ton models, one and 11/2-ton models, two-ton and three-Four-ton custom-built ton models. models are available. Wheelbases range from 116 in. to 220 in. There are several engines rated from 73 to 85 hp. Special axle ratios and two-speed axles can be secured optionally. Features on one or more of the series include power take-off, semi or full-floating rear axles, and hydraulic brakes.



Victor Mfg. & Gasket Co. has issued a retainer list No. 27 on its oil seals and gasket retainers.*

A trailer service and information handbook has been prepared by the Covered Wagon Co.

Wagon Co.

A pamphlet entitled "Machines and Working Hours" has been published by the Machinery and Aliied Products Institute.*

The October issue of Nickel Steel Topics contains a number of items referring to the application of nickel steels to automotive

A folder on Flexrock has been issued by the Flexrock Co.*

The U.S. Department of Agriculture has The U. S. Department of Agriculture has completed large scale maps of the existing transportation systems in 13 states including Connecticut, Delaware, Florida, Iowa, Maine, Maryland, Massachusetts, New Hampshire. Oregon, Rhode Island, South Carolina, Vermont and Washington. They are available at 20 cents a sheet.

Landis Tool Co. has issued an illustrated catalog, No. K-137, on the 12 by 28-in. Universal tool grinder.*

The Bristol Co., Waterbury, Conn., has issued a new bulletin describing temperature recorders and controllers for furnaces, kilns and industrial ovens. It is No. 462.*

Hobart Brothers Co. has issued a catalog describing the company's new 40-volt sim-plified arc welder. Controls and equipment are also described.*

The Niagara Machine Tools Works has issued a new bulletin, No. 58G, giving specifications and illustrations of the complete line of the Niagara Master Series A and Standard Series inclinable presses.*

Wheelco Instruments Co. has issued two new bulletins describing and illustrating the construction and applications of its temperature regulating devices, Capacitrols and the new Proportioning Controller.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chest-nut and 56th Sts., Philadelphia.

Chrysler Kansas City Grows

Negotiations have been completed for the third major expansion of the Chrysler Corporation facilities in Kansas City within the last two years.

The present parts depot was the first major unit and provided 50,000 sq. ft. of floor space. This was later enlarged. There is now planned the expansion of the parts depot to a building 444 ft. by 350 ft. giving 155,400 sq. ft. of floor

Employment Index Dips

Temporary shut-downs for change-over in models resulted in a decrease of 5.3 per cent in September employment in the automobile industry, according to the Bureau of Labor Sta-The employment index in tistics. September dropped to 112.3 from 118.7 in August and rose from 90.3 in September, 1936. The three-year average of 1923-1925 equals 100. Automobile payrolls declined to 105.4 in September from 115.3 in August, but reflected a sharp increase over last September when the index stood at 77.3.

Books

of automotive interest

Proceedings of the Twenty-third Annual Road School held at Purdue University, Purdue, Ind., Jan. 25-29, 1937. Compiled by Ben H. Petty, Professor of Highway Engineering. Engineering Extension Se-No. 39. Published by Purdue University.

The bulletin contains the papers which were presented at the school and which deal with subjects of interest to road builders and traffic administrators.

Services of the National Bureau of Standards to the Consumer. Published by the U. S. Department of Commerce.

The National Bureau of Standards cooperates actively with all groups interested in establishing dimensional and quality standards, eliminating superfluous sizes and varieties, and in unifying specifications. In the publication under review, brief summaries are given of the work which has been conducted or is now going forward on a number of the more important items of general interest to consumers. The items referred to include automobiles and automotive equipment.

Proceedings of the Automotive Engine Rebuilders Association at its Fifteenth Annual Convention, held at Hotel Sherman, Chicago, June 21-24, 1937. Published by the Association whose headquarters are at 415 North Capitol Ave., Indianapolis, Ind.

The pamphlet covers the full proceedings, including the discussions on papers.

Penetration of Oil Sprays, by P. H. chweitzer. Engineering Experiment Sta-Schweitzer. tion Bulletin No. 46. Published by (Turn to page 658, please)

Stettinius Heads Steel Board

Edward R. Stettinius, on Oct. 26, was proposed as chairman of the board of the United States Steel Corp., his election to take place at the next annual meeting of stockholders, April 4, 1938. The announcement coincided with announcement of the relinquishment of the post of chairman by Myron C. Taylor. Mr. Stettinius has been with the corporation since 1934, resigning then as vice-president of the General Motors Corp. in charge of industrial and public relations. He joined GM at the company's invitation in 1924 soon after his graduation from the University of Virginia.

Car Sales Index Down

The preliminary adjusted index figure of the value of retail sales of new passenger automobiles declined sharply from August to September, according to the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Th's index, which makes allowance for the number of days as well as for seasonal movements was 105.0 in September, on the basis of 1929-1931 average as 100 compared

movements was 105.0 in September, on the basis of 1929-1931 average as 100 compared with 120.5 in August and 104.5 in July.

Sales in September according to these preliminary figures, were 3 per cent above September, 1936, and 46 per cent greater than in September, 1935. Daily average sales, without seasonal adjustment, decreased about 35 per cent from August to September. September.

Contour Machine

(Continued from page 637)

feed can be released instantly by pedal. The work table has four-way tilt, and a new type of detachable disc cutting unit is furnished. Work thickness capacity is eight inches, although this model, as well as the smaller Metalmaster, is made on special order to cut up to 12-in. thickness capacity.

Calendar of Coming Events

DOMESTIC SHOWS

New York, National Automobile Show, Oct. 27-Nov. 3 Toledo, O., Automobile Show. Oct. 27-Nov. 3 Boston, Mass., Automobile Show, Oct. 30-Nov. 6 Washington, D. C., Automobile Show, Oct. 30-Nov. 6 Los Angeles, Cal., Automobile Show, Oct. 30-Nov. 7 San Francisco, Automobile Show. Oct. 30-Nov. 6 Cincinnati Automobile Show.Oct. 31-Nov. 6 Altoona, Pa., Automobile Show....No Wilmington, Del., Automobile Show, Nov. 3-6

Omana Automobile Show......Nov. 6-12
Motor Truck Show, 4th Annual,
Newark, N. J...........Nov. 6-12
Newark, N. J., Truck Show...Nov. 6-12
Buffalo, N. Y., Automobile Show...Nov. 6-13
Indianapolis, Automobile Show...Nov. 6-13
Philadelphia Automobile Show...Nov. 6-13
Philadelphia Automobile Show...Nov. 6-13
Pittsburgh, Pa., Automobile Show...Nov. 6-13
Jersey City, N. J., Automobile Show,
Nov. 8-13

Baltimore, Md., Automobile Show, Nov. 13-20 Cleveland, Ohio, Automobile Show, Nov. 13-20

SHOW BUSINESS

Manager of the National Automobile Manager of the National Automobile Show in New York is Alfred Reeves, 366 Madison Ave., N. Y. C. Inquiries concerning all matters connected with the national show should be addressed to him. AUTOMOTIVE INDUSTRIES will be pleased to furnish names and addresses of local show managers on request.

Rochester, Automobile Show.....Nov. 13-20 Springfield, Mass., Automobile Show, Nov 14-20 St. Louis, Mo., Automobile Show. Nov. 14-21 Portland, Ore., Automobile Show. Nov. 14-21 Denver, Colo., Automobile Show, Nov. 15-20 Milwaukee, Wis., Automobile Show, Nov. 17-24 Kansas City, Mo., Automobile Show, Nov. 27-Dec. 4 A.S.I. Show, Navy Pier, Chicago, Dec. 6-Dec. 11

FOREIGN SHOWS

Italy, 10th International Automobile y, 10th international Automobile
Salon, MilanOct. 28-Nov. 8
at Britain, 13th International
Commercial Automobile Exposition
(trucks and buses), London...Nov. 4-13

Peru, Automobile Show, Lima, Dec. 23-Jan. 6, 1938

CONVENTIONS AND MEETINGS

nual Meeting, New York City...Dec. 1
American Society of Mechanical Engineers, New YorkDec. 6-10
SAE National Production Meeting,
Flint, Mich.Dec. 8-10 By W. F. BRADLEY

ORTY-FIVE passenger car makers are united in the thirty-first Paris automobile show. There are 21 French makers, seven from U. S. A. (Chrysler, Graham, Hudson, Lincoln, Packard, Nash and Studebaker), five each from Germany and England, four from Italy, two from Tchekoslovakia, and one from Belgium. French makers are a minority.

The number of French makers is shrinking. Rochet-Schneider, Lorraine-Dietrich and De Dion-Bouton are pro-

ducing trucks only;
Mathis has been
absorbed by Ford;
Amilcar has been
purchased by
Hotchkiss; Hispano-Suiza is not
exhibiting and may
cease to produce
passenger cars,
and several smaller
concerns have ceased to exist.

Disturbed social conditions having held back all new models last year, this show really embodies two years' technical progress. With heavy taxes on

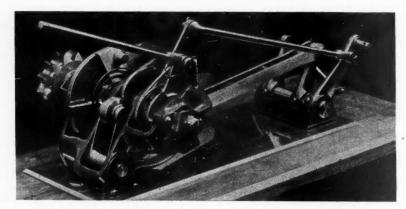
gasoline and rising operating costs, the natural move is to smaller and lighter cars. There is a crop of new models with four-cylinder engines varying from 50 to 70 cu. in. Practically no new "sixes" or "eights" have been produced, while several makers in this division have added a four. Among big producers, Renault, Fiat and Hotchkiss have come into the class below 67 cu. in. Citroen is about to follow. The "everyman" car which Hitler tried to impose on Germany is coming by evolution.

One of the high spots of the car is independent suspension. This has taken hold to such an extent that (excluding England) it is hard to find a European car without at least two wheels independently sprung. The tendency now is towards four wheels independently sprung. Important recruits are Renault, Hotchkiss, Fiat, Alfa Romeo.

The frame composed of parallel side members (the latter sometimes of box section) appears to be passing out, and probably the development will be a unit frame and body. The central backbone diameter tubes are used for both side rails and cross members on the latest Salmson; another example of a frame consisting of big-diameter tubes, little known to the public, is that of the Mercedes racing machines.

Automatic or semi-automatic transmissions have not reached the production stage, but at least half a dozen are being experimented with. The Wilson pre-selective gear is limited to the French Talbot, but this firm has also taken up the Maybach transmission. The Cotal planetary transmission, with

electro - magnetic control, has been adopted by Peugeot, Delage Salmson and Unic. Bugatti and Delahaye occasionally use this gear, and Berliet is negotiating for its adoption. André Dubonnet. claims that he has perfected a fully automatic transmission and that two American factories have it under test. This transmission is not



Model of friction type brake servo used by Renault

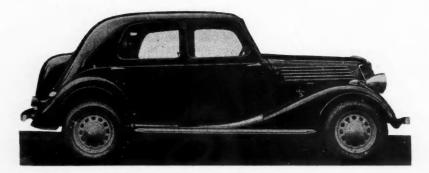
frame employed by Mercedes and other German firms, and by Skoda, the double Y frame used by Fiat; the electrically welded one-piece

frame with body welded to it, adopted by Renault; the Lancia one-piece frame and lower part of body; the compound aluminum frame and body introduced by Hotchkiss, are all important as indications of the general trend. Big-

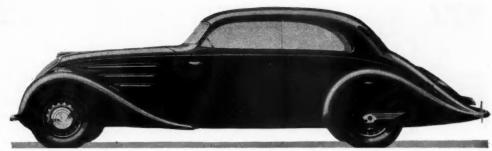
Paris Show Has

in the Paris show. The Minerva-Imperia torque converter, under R.v.R. patents, which appeared at the Brussels show, is demonstrated, but it does not appear to have gone into production. There is little development on overdrives. Unic, using the Cotal gear, has a direct third and an overdrive fourth speed.

Front-wheel drive is generally limited to small cars. Citroen produces both front and rear drivers, the majority being front. Hotchkiss is the only important newcomer in this class.



Renault 4-door sedan, Primaquatre model Peugeot 2-door coach



Important changes have been made in frame design. Panhard presents a chassis without any frame members. It comprises a six-cylinder sleeve valve engine, with unit transmission, a torque tube containing the drive shaft, connecting to a circular-section rear axle (probably 12 in. diameter) and uniform throughout its length, containing a worm gear. Torsion-bar suspension is used in front, with wishbones, the upper wishbone being attached to the forward crankcase hangers and the lower one to the fore-and-aft torsion bars. The steering gear is mounted on the rear of the cylinder casting, the main steering arm being an inverted U straddling the clutch housing and operating a diagonal drag link going to each front wheel. The rear suspension is by torsion bars mounted behind the axle housing. The body is mounted on six points: two at the rear, two above the clutch housing, and two additional ones

on the forward crankcase hangers.

Voisin has a frame only 2 mm. (0.080 in.) thick, the channel side members having a height of 8 in. Extensions of this frame at front and rear, curved to provide clearance for the axles, have a height of 15 in. All the space between the side members is filled in, flush with the lower flange, forming the floor of the car, a tunnel for the drive shaft being formed in this flooring. The dashboard forms an integral part of the chassis and adds to its rigidity. The parts are electrically welded. An advantage claimed for this chassis construction is that it can be produced cheaply without the aid of expensive presses. Voisin installs the Graham supercharged engine in this

Adler has a one-piece chassis, comrosed of box-section side rails, with welded-in flooring comprising the driveshaft tunnel, dash and instrument

board welded to the chassis and a welded-on, one-piece body. Praga is another example of a one-piece chassis.

The Opel Kadet has a one-piece chassis with welded-on steel body. Renault's latest job is very similar to this, in so far as chassis and body are concerned. Lancia has a one-piece frame, the flooring and the drive shaft tunnel being a single pressing.

Practically 90 per cent of Continental cars have independent suspension, the majority of these having knee action in front, but an increasing number attach all four wheels independently. The type which is most in evidence is the cross spring with wishbone attachment. Some of the makers who have used this now have two wishbones, with the spring shackled, so that it has to assume no other function than suspension. Indications are that the very few holding to rigid axles will change over in the near future. Apart from whatever technical

More Low Horsepower Models

Independent Suspensions at Paris Show

French

Delage: Cross spring, wishbones, front Falbot: Cross spring, radius arms front wishbones,

Delahaye: Same La Licorne: Same

Renault: Cross spring, wishbones, front Berliet: Shackled cross spring, double

Berliet: Shackied cross wishbones, front Chenard - Walcker: Shackied cross springs, double wishbones, front Delaunay Belleville: Cross spring, wishbones, front Peugeot: Cross spring, pivoting arms,

Panhard: Torsion bars, front, rear Salmson: Torsion bars front

Citroen: Torsion bars front, rear Simca Fiat: Cross spring, wishbones, front; Dubonnet system, front Unic: Half elliptics, double axles, Unic: front

Hotchkiss: Two cross springs front; torsion bars, rear

Germany

Opel: Dubonnet system, front

Opel: Dubonnet system, front
Mercedes: Cross spring, wishbones,
front; coil springs rear; Coil springs,
wishbones, front; coil springs rear;
Double cross springs front; coil Double cross springs front; coll springs rear Hanomag: Cross spring, wishbones,

front

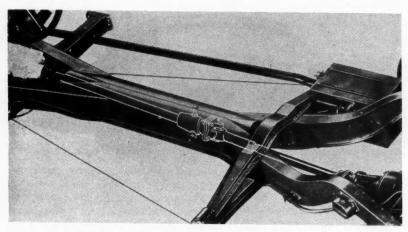
Adler: Cross spring, wishbones, front; cross spring, radius arms rear Maybach: Coll springs, wishbones, front; Cross and coll springs rear

Fiat: Cross spring, wishbones front; Dubonnet system front

Lancia: Coil springs, hydraulic damper, front; cross spring, radius arms, rear Alfa Romco: Enclosed coil springs

Czechoslovakia

Praga: Cross spring, wishbones, front; cross spring, radius arms rear Skoda: Cross spring, wishbones, front



Fiat 1500—The transmission shaft, divided into two portions with an intermediate bearing, passes through hollow central girder of the frame. Box section double Y frame of $91\frac{1}{2}$ cu. in. Fiat. Drive shaft passes through central backbone

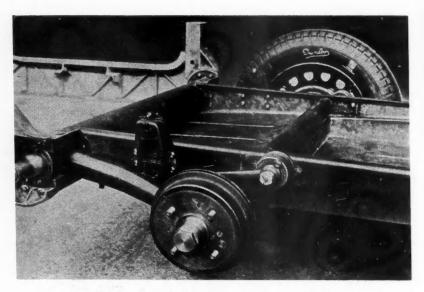
fitted with a stop adjustable from the instrument board, enabling the driver to set for any maximum he desires. The stop can be overrun by pressing hard on the accelerator and on release the stop again takes up its action. Headlights are mounted on the side of the radiator and appear to be in a fairing between hood and fenders. The top of the hood is hinged at the rear and is locked by the false radiator cap. The side portions of the hood are fixed. A three-speed transmission is used, the drive shaft being carried in a tube. Suspension is by means of a transverse spring at the rear, the spring being considerably offset in relation to the axle. The spare wheel is on the tail of

advantages are to be gained, knee action is a very powerful selling argument in Europe.

There is little attempt to apply the Diesel to passenger-car use. The only job of this type in the show is a Hanomag four-cylinder of 122 cu. in., giving 32 hp. at 3500 r.p.m. Citroen has a Diesel of about the same size, but he is only putting it into light trucks. While European military advisers are seeking to develop the use of producer gas plants, there is only one example for passenger-car service. This is shown by Berliet and makes use of the Imbert wood-burning generator. It is mounted at the rear, in the place of the usual trunk, and there is nothing external to indicate that this is not a gasolineburning automobile. Despite undoubted economy, there are no indications that the public is prepared to accept gasproducer plants for private cars.

Breaking away from tradition, Renault has adopted independent front-wheel suspension for a new four-passenger, four-cylinder 61-cu. in. light car selling in France at \$550. This is the cheapest four-passenger job on the French market. Independent suspension is not the only feature of the new Renault product. The entire chassis is a single unit into which the powerplant transmission and springs are mounted, and the all-metal body is welded to the chassis.

In building up the chassis, profiled, box-section side rails are used; there is a cruciform construction, also of box section, to receive the engine, all the space between the side rails is filled in, this filling forming the floor, the wells for the front seats, the tunnel for the drive shaft, and a cross member to which the rear transverse spring is bolted. The rear bumper forms a part of the chassis, and at the rear there is



Hotchkiss rear end bolted to aluminum alloy frame

a recess into which the gasoline tank is dropped. When it goes to the assembly line, the chassis forms a single unit, for all the component parts have been welded together. After the power plant and transmission have been added, the body is welded to the chassis, thus forming a one-piece chassis-body construction from which the mechanical parts can be dismounted for repairs.

Renault's front suspension consists of a transverse spring and a wishbone, the attachment of the wishbone being onto the hydraulic shock absorber shaft, which latter is mounted on top of the box-section frame. The main steering arm carries two ball heads, so that there is a separate track rod for each of the front wheels.

The Renault engine is a four-cylinder L-head type of exactly 61 cu. in. capacity. It has thermo-siphon water circulation and a mechanical fuel pump. A Solex carburetor is used, this being

the car. Access to the luggage compartment is from the interior, by folding down the hinged backrest. The windshield is fixed, and the body is of full chassis width, eliminating running boards.

Among the less important changes on the other Renault models is the adoption of a friction-type brake servo. The thermostat in the cooling system has been dropped on the grounds that lime and other impurities in the water often interfered with its operation. Owners are advised to blanket off a portion of the radiator in cold weather.

Two new models are presented by Fiat. One has a four-cylinder overhead valve, aluminum-alloy head engine of 66 cu. in., the other a six-cylinder 91-cu. in. engine, also with valves in an aluminum head. Both cars have independent suspension in front, with a r.gid live axle, semi-elliptic springs, and a traverse stabilizer bar.

While both Fiats have an adaptation of the Dubonnet suspension, the smaller job has vertical cylinders containing the coil springs operating in oil, with a wishbone attachment to the frame near the base of the cylinder, and an arm with a yoke at its outer end secured at the head. On the 91-cu. in. model a forged I-beam axle is used, with very open yokes, with the suspension cylinders mounted horizontally in these and, of course, turning with the steering pivots. While the smaller Fiat has a box-section chassis with X-type cross members, the bigger model has a double Y chassis, with the drive shaft passing through the backbone and having a steady bearing in it, and the branches of the rear Y more widely open than those of the front, to receive the axle mounting and the fuel tank.

A weight of 1650 lb. for a two-door four-passenger car having a wheelbase of 98 in., track of 49 in., height of 49 in., and powered by a four-cylinder 66 cu. in. engine, has been obtained in a new Hotchkiss construction having an aluminum-alloy combination frame and body. Built under Gregoire patents, this new Hotchkiss is an attempt to get into the economical four-passenger light-car class. Heat treated Alpax castings (silicon-aluminum alloy) are used for the two side frame members, the forward cross member, and the front body assembly, consisting of dashboard, cowl, windshield frame and the front portion of the roof. The side frame members have a minimum height of 6.6 in. and a maximum of 8.6 in. and are declared to be equal in strength to

the frame members of the average 2-ton truck.

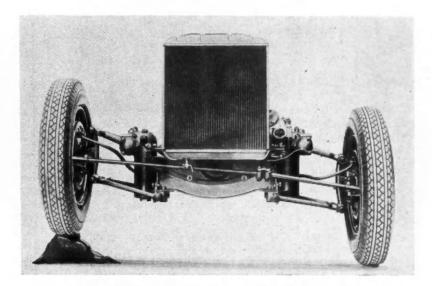
The four light-alloy castings are assembled by bolts, the forward body unit resting on the side rails and also fitting between them, thus forming an additional frame cross member. It is bolted to the side rails in both a horizontal and a vertical plane.

The rear assembly of the car, comprising rear wheels, rear suspension and luggage platform, comprises two light pressed-steel, channel-section side rails united at the front by a steel tube of 6-in. diameter, and at the rear by a lighter tube. The space between the side rails is filled in with sheet

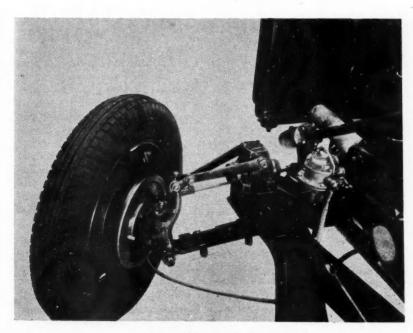
metal welded to the rails.

The forward tube carries the torsion bars for rear suspension, and when this assembly goes to the line it is complete with wheels, brakes and suspension. The big-diameter tube has flanged ends, by means of which it is bolted to the end of the aluminum-alloy frame, as shown in the illustration. There are six bolts, on each side. At each end of the aluminum-alloy frame there is a hollow, vertical post, forming a part of the casting.

The complete chassis assembly weighs 990 lb., leaving 660 lb. for the body and fittings. It seems possible to save on this latter weight. The body is a



Front end of Fiat 4-cyl. 66 cu. in. job with Dubonnet vertical-cylinder independent suspension



Renault front suspension

sheet-metal construction with a light wood frame, the separate panels being welded together to form one unit. It comprises roof, tail members and side panels. Two wood frame members, forming door posts, drop into the hollow post castings on the chassis. The forward edge of the roof is bolted to the edge of the front panel forming a part of the chassis. After being bolted, solder is run in to form an invisible joint. The side panels are attached in the same way to the top of the side rails. The rear body panel is secured by small bolts to the chassis tail assembly. Space between the aluminum-alloy side rails is filled in with sheet steel panels, forming a floor. There is thus an unbroken underpan.

The Hotchkiss is a front-drive job and in consequence has independent suspension in front. Two transverse springs are used, the upper one lodging in a channel formed in the Alpax cast-

One Color Cars Predominated

ETALLIC colors did not play as important a part in the Paris automobile show as was expected, according to a detailed report of the Paris show from P. H. Chase, color specialist of the Duco Color Advisory Service. Out of 298 cars exhibited, only 25 appeared in metallics.

From the color point of view, the most outstanding feature of the show is the loss of supremacy by black, which has been the most popular color at the Paris shows for years, with blue usually a close second. This year, however, blue stepped into the lead, placing black into second place, on an equal footing with gray. Blue was exhibited in a number of different shades and was used prominently in several composite colors where its dominance was unquestioned. As reported by Mr. Chase, colors were distributed as follows:

Blue	59
Black	51
Gray	51
Maroon	43
Yellow family	36
Green	28
Beige	15
Brown	10
Red	. 5
	298

Peugeot this year exhibited eleven cars in gray, all metallic, while Hotchkiss had on display seven cars of a dark reddish maroon. This is the first time that manufacturers have had all of their cars in one color; each evidently felt he was catering to the popular taste. It is true that the maroons make a very effective showing and that just at this time maroons are popular in the dressmaking trades. Such, however, can hardly be said of gray.

The yellow family, which ranked fifth in popularity, was somewhat in the same position as blue, in that it offered a great number of varying shades ranging from a yellowish white to deep yellow and running the gauntlet through cream and ivory. There were also several composite colors in which the yellow tinge was prevalent. This color family has been coming forward in the last two or three years, each of the shows within that time having demonstrated its increasing popularity.

Green, which dropped to sixth place, was much less in evidence than formerly. It is sponsored, also, by the dressmakers this season, but evidently it had not found the same favor with automobile manufacturers.

As a rule, the cars exhibited were all of one color, including fenders and wheels. The only means of decoration resorted to consisted of accentuating the belt molding either with chromium or by very narrow stripes, or fillets, of a contrasting color. There were still quite a number of fancy louvers, some of which were enhanced with chromium giving a relief to the present simplicity of one over-all color. Streamline principles were still applied in the exhibits, but very conservatively, with the exception of an exhibit by Letourneur & Marchand, body makers.

ing and being secured to it by clips, and the lower spring being in the channel of a pressed-steel cross member bolted to the light alloy cross frame member. The pressed-steel cross member also carries the hydraulic shock absorbers. The power is taken through a fourspeed transmission and transverse shafts with Tracta-Bendix joints. Steering is by rack and pinion, the rack being mounted on top of the aluminum frame cross member. Gears are shifted by means of a combination of levers and cables, the operating lever being on the instrument board and working in a slotted sector. Patents are claimed for this feature.

This compound construction gives an extremely rigid chassis and body. Absence of frame deformation adds to the roadability of the car and the precision of steering. The engine is of normal design, of the L-head type, but probably later will be replaced by a pushrod engine of the same size; it has flexible rubber mounting, the rear mounting being on the metal dashboard. The fuel tank is on the front of the dash, the steering column passes through the dash, and the 12-volt battery is carried in the frame, at the side of the engine. Deliveries of this model are promised for the end of the year.

The problem of visibility from the driver's seat has been solved by the use of hardened safety glass, of 10 to 12 mm. (% to ½ in.) thickness, without a frame. Windshields of this glass are treated like a metal panel, being bolted to the body and adding to its rigidity. There are various examples in the show, both on closed and convertible cars. In the case of the latter the glass is drilled to receive the locking device securing it to the top. The side windows are treated the same, the window lifter being in the glass itself.

Where two glass panels come together it appears to be impossible to get a perfect fit, but it is claimed that drafts are avoided by overlapping. The windshield, for instance, extends laterally about two or three inches beyond the side panels. Where there are two or three side panels, the edge of one overlaps its neighbor. There also are examples of curved windshields, following the contour of the body. Henri Labourdette, Paris body builder, is responsible for this development. Applications are shown also by the Letourneur & Marchand Body Co.

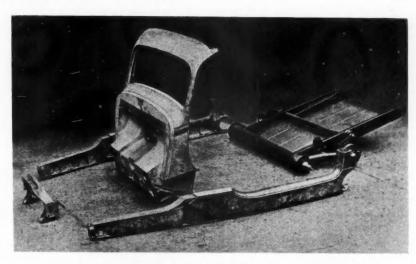
Renault came forth at this show as maker of its own tires. Machinery has been imported and a plant is now in operation at Billancourt. It is not known what proportion of cars is fitted with Renault tires, but the aim is to make this 100 per cent.

The explanation of this move given

by Renault officials is that it always has been a policy to avoid being dependent on any one firm for any particular part. When Michelin secured control of the Citroen company after André Citroen's crash, Renault ruled out Michelin as a source of supply. The only other big tire manufacturer was Dunlop and refusing to be dependent on this one firm, Louis Renault decided to lay down a tire-making plant. Citing the example of Henry Ford, French tire manufacturers predicted that Renault would not dare make this move, notwithstanding the fact that he had a nucleus in a company making all the tires for his fleets of taxicabs.

Renault's policy always has been one of complete independence. He produces his own steel, all his castings and forgings, makes his own cloth, felt and rubber equipment, refines his own oil, and has a controlling interest in the company supplying him with electrical equipment.

Compared with last year, car prices are up on an average 24 per cent. The increases differ considerably, the lowest being 4 per cent and the highest 49 per cent. On four different models, Renault's increases are 21, 33, 38 and 48 per cent. Citroen has increased 7, 10, 25 and 35 per cent; Peugeot 12.5 and 30 per cent; the French Fiat 21, 23 and 41 per cent. Louis Renault maintains that these increases are moderate. "Labor charges have increased 72 per cent; raw material costs are 55 per



The five elements constituting the frame and body of Hotchkiss light car

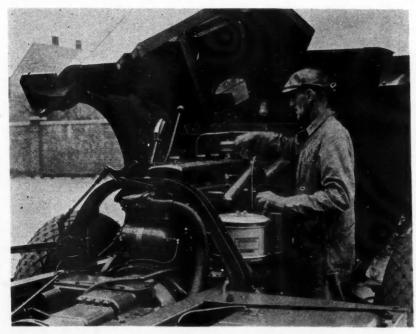
cent more, making with overhead charges an average of 68 per cent. Despite this we have held car prices down to 35 and 40 per cent increase."

Repair and service charges have uniformly increased 45 per cent during the past twelve months.

The government premium on car exports has been withdrawn. Despite the average 24 per cent increase on the home market, French prices in terms of dollars are very much lower than a year ago. This is explained by the drop

in the value of the French franc. Worth 15 to the dollar at the opening of the last show, the average rate is now 30 to the dollar. Certain expensive French cars, which have undergone but a slight increase in price, are now selling at nearly half last year's price, in dollars.

American importers are badly hit by this drop in the value of the franc. They all maintain, however, that the quota system is a still greater handicap, making it impossible for them to import all the cars they could sell.



CAB TILTS forward on this new white, heavy-duty, cab-over-engine models \$20\$. The cab, grille and bumper are designed to be moved out of the way for service operations and it is said

that the operation can be performed by two men in a few minutes. Engine in the new truck is a six, having 434 cu. in. piston displacement. Standard wheelbase is 109 in., but there are optional wheelbases up to 193 in.

Muskegon Output Detailed

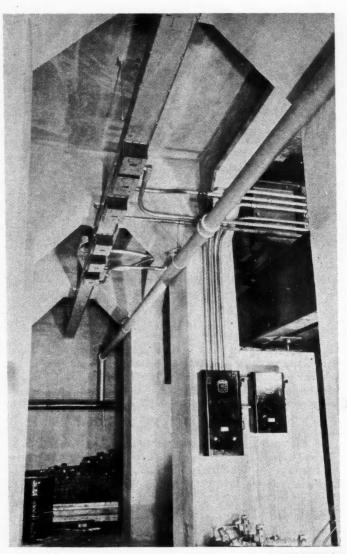
Figures on the volume of piston ring castings and finished rings produced by the Sparta foundry division of the Muskegon Piston Ring Co. and by the parent company have become available in a listing application to the New York Curb Exchange.

The machining division continues to sell three-quarters of its output to one manufacturer of cars, and one-quarter to another manufacturer. Both buyers distribute through dealers for used caruse. Sparta sells the portion of its output which does not go to the Muskegon division to about 40 customers.

Following is a table of the division of business, 000 omitted:

proc		sold to		to kegon	Rings pro- duced by Muskegon
1932	37,27	74	51	49	19,150
1933	58,27	6 4	17	53	27,598
1934	70,43	10 4	1	59	39,249
1935	89,92	6 3	39	61	51,422
1936	83,27	2 3	34	66	49,780
6 mos. 1937*	47,80	00 :	26	74	33,136

^{*}The company estimates full year production of 84,000,000 castings of which 57,-000,000 will be fabricated into finished rings by Muskegon.



serves production machinery, including machine tools, power presses, welders, spray booths, etc.; the second and more familiar unit is the high-cycle (high frequency current) system for assembly line portable power tools. Reference to the description* will show that the plant is composed of two separate buildings—a three-story main unit, housing the administration building, assembly lines, and finishing departments; and the new press shop. Consequently, it was necessary to develop the power distributing units independently for each building.

The major distribution system, serving the production machinery, consists of independent sections of Trumbull Electric Co., "Flexi-Power" duct serving various departments. The novelty in the Flexi-Power installation is that it supresedes and eliminates the time-honored cable wiring. Instead, it provides a uniform, rectangular duct containing three heavy copper buses, mounted conveniently at the ceiling. The duct has power outlets spaced 12 in. apart for plugging-in the individual power jacks with feeder cables.

Advantages claimed for this system of power distribution are:

Looking up at one of the three "Flexi-Power" ducts serving the battery of huge presses in the DeSoto press shop. These power lines are suspended from the ceiling in the basement service gallery directly under the main press room floor, permitting the use of extremely short power feed lines through the floor to the machines above

By Joseph Geschelin

WHEN the new DeSoto plant* opened its doors, it incorporated in its construction one of the earliest and most outstanding examples of the modern trend in flexible power distribution.

DeSoto's power distribution comprises two different types of systems the major (and most interesting) unit

*Described in AUTOMOTIVE INDUSTRIES, Feb. 6, 1937.

View in new DeSoto press shop taken in the assembly department. Overhead, in the foreground will be found a section of the Trumbull "Flexi-Power" duct suspended from the roof truss. This is a short section serving as the feeder for the group of welding machines



Flexible Power Supply

As Provided by Modern Wiring in the DeSoto Plant



Rear axle assembly line at DeSo:o is typical of the high cycle portable tool lines used in this plant. The tools receive high-frequency energy from the Bull-Dog "Nol-E-Duct" which may be seen directly overhead.

Safety—due to absence of dangling wires and conduit lines.

Flexibility—due to frequency of outlet spacing which permits a better disposition of machinery, and enables the plant engineers to shift machines at will without affecting wiring in any way.

Better housekeeping—since the power duct is out of the way, it can be painted to suit the general paint treatment of the plant; it eliminates all dangling wires.

Over-all economy—since the power lines are laid out with greater efficiency, resulting in improved distribution of current with less loss through the lines.

Flexi-Power ducts for each of the two buildings are served from switch rooms, one in each building, A.C. current to each duct section being carried in covered conduit cable. All motors are of A.C. type, the current being 3-phase, 440 volt, with bus bars rated at 250 and 500 amp. capacity.

The floor plan of the press shop, indicating the disposition of power distributing ducts, illustrates the convenience of the bus-duct system. It will be noted that the switch room is centrally located with separate cable

feeder lines to each bus duct. The two long duct lines at the left are each 280 ft. in length, and serve the sheet metal assembly lines and equipment.

The three, 130 ft. duct lines shown at the right, serve the huge presses in the main production section of the plant. Instead of being ceiling-suspended, the three lines are mounted in the basement gallery directly under the presses so that the power cables consist of very short leads through the floor.

In addition to the three main duct lines in the press shop, there is one 40-ft. section for welding machine circuits. This handles welding machines only, thus relieving other lines of a severely fluctuating load.

The main building has a multiplicity of bus duct sections in various departments, all served from a common switch room. In addition, there are two separate rooms in the paint shop in which the groups of starters and supply lines for the various spray booths are housed for safety.

Among the principal bus duct lines here are the following:

First Floor

Two 40-ft. lines; two 20-ft. lines, and three 10-ft. lines.

Note: These are rated 250 amp. ca-

Second Floor

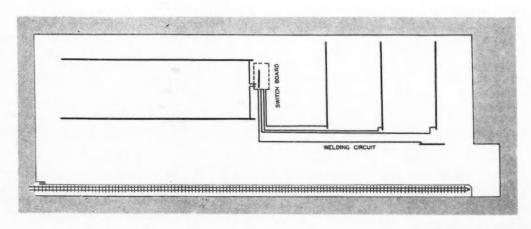
One 160-ft. line of 500 amp. capacity; one 60-ft. line of 250 amp. capacity.

Third Floor

Four 40-ft. lines; one 20-ft. line, and one 30-ft. line.

(Turn to page 652, please)

Floor plan of press shop showing principal "Flexi - Power" duct lines. The two long lines at the left serve as se m bly lines and small machinery. The three lines at the right are those located in the basement gallery under the heavy press lines. The short horizon al line in the lower right-hand section is the power line serving welding machines



Driving Torque Sustained During Gear (

By P. M. HELDT

N automatic transmission of the stepped type in which the change from one speed ratio to another is made by means of multipledisk friction clutches and in which the automatic feature can be "overridden" by the operator at will, has been developed by J. W. Hale of Newton Center, Mass., and is the subject of several U. S. patents. The transmission gives three forward speeds (including a direct drive) and reverse, and one of its outstanding features is that there is no interruption in the driving torque while the change from one gear ratio to another occurs. By means of a small lever the gear is set for forward or reverse motion before the car is started; thereafter the control is entirely by means of the accelerator pedal.

Referring to the longitudinal section of the transmission, Fig. 1, the driving shaft A carries a pinion B that meshes with idler gears C,C, which latter are formed integral with two other idlers, D,D, respectively. Idlers D,D mesh with the driven gear E on the intermediary shaft F. These idlers are supported by an idler carrier G, and when driving shaft A rotates in the clockwise direction, owing to the reactions between the teeth of the idlers and the gears meshing with them, the carrier will rotate in the counter-clockwise direction. Associated with carrier G is the one-way clutch H through which internal gear I is driven from the carrier. This internal gear meshes with idlers K,K, which latter are formed integral with idlers J,J, respectively. These various idlers are mounted on stationary bearing studs extending into the housing from the forward wall thereof. Idlers J,J are in mesh with gear L, which is mounted concentric to driving shaft A and is in driving relation with that shaft through the oneway clutch M. Since the idlers are stationary in space, if we designate the numbers of teeth of the various members of this gear train by i, k, j, l, the speed of the driven gear L (which, of course, will be the same as that of driving shaft A), will be i j/k l times that of the internal gear. In the actual transmission the ratio is about 5. so that internal gear I and idler carrier

G rotate backward, or in the counterclockwise direction, at about one-fifth the (forward) speed of driving shaft

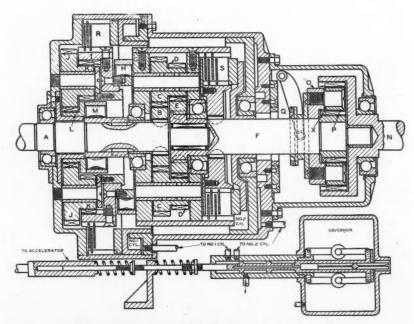
It can readily be seen that if idler carrier G were stationary in space, then the driving shaft A would drive the intermediary shaft F through the gear train B-C-D-E at a reduction ratio e c/d b, which in the gear here shown is equal to approximately 1.60. This is actually the intermediary-speed ratio, for in intermediary speed the pinion carrier G is held from rotation, as will be explained further on. With the pinion carrier rotating in the reverse direction the reduction ratio is considerably greater, actually about 2.8. This, then, is the low gear, which becomes effective as soon as the engine clutch is allowed to engage. From the intermediary shaft F to the main-drive shaft N the power is transmitted through the reversing gear shown at the right, which is locked for forward drive by clutching the idler carrier O to the driving gear P at X, whereas, for backing the idler carrier is clutched to the stationary housing at Q. The reversing gear is hand-controlled, the shift into

forward or reverse being made before the car is started, so there is no shifting with the car in motion.

The change from low forward speed to intermediate is made by locking internal gear I in position against rotation, by means of the multiple-disk clutch R, by admitting oil under pressure to cylinder No. 1. This holds pinion carrier G from rotation, and the reduction between the driving shaft A and the main drive shaft N is then through the gear train B-C-D-E, which, as stated, gives a reduction ratio of 1.60 or thereabouts.

For direct drive, pinion carrier G is locked to the intermediary shaft F by means of multiple-disk clutch S, which is accomplished by admitting oil under pressure to cylinder No. 2.

The oil pressure made use of for the control of the transmission is that of the engine lubricating system. The oil is admitted to cylinders Nos. 1 and 2 by a slide valve which is under the control of a flyball-type governor, and this governor can be "overridden" by the operator by means of his accelerator pedal. The entire control mechanism is shown (more or less diagram-

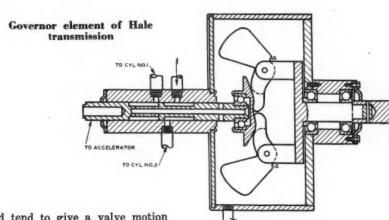


Longitudinal section of Hale automatic transmission

Changes in Automatic Transmission

matically) at the bottom of the longitudinal section. At the right is shown the governor housing, with provisions driving the governor from the speedometer drive shaft. The governor weights act directly on the slide valve, against the pressure of a fixed governor spring. The higher the car speed, the greater the force on the flyballs, and the farther they will move out from the axis of rotation, at the same time moving the oil-control slide valve axially to the left. It will be seen that oil is admitted first to cylinder No. 1 the intermediary (which engages speed), and at a higher car speed to cylinder No. 2, which engages the direct drive. There is also a second spring on the valve, whose tension can be varied by the driver by means of the accelerator pedal, who can thus influence the car speeds at which any particular shift is made. Assume, for instance, that the car is running at 20 m.p.h. and that the shift into direct drive is about to take place; then, by further depressing the accelerator pedal, the governor spring is stiffened and the shift into high is delayed until considerably more speed has been gained. Ordinarily, when the driver wants the shift to a higher gear to take place, he lets up momentarily on the accelerator pedal. This eases the spring pressure and allows the governor to make the shift readily.

Fig. 2 is a section of the governor used with this transmission. There are two pairs of oppositely-located governor weights in the housing, one pair being arranged at right angles to the other. Both pairs of weights, of course, rotate at the same speed, and both act together (or in parallel) on the slide valve for the change from low to intermediate speed. After this shift has been made, the "low-speed" governor weights (with the short radial arms indicated by dotted lines) come up against stops on the mounting yoke (at a,a) and become ineffective. This leaves only the "high-speed" governor weights. which act on the valve through longer lever arms and therefore with reduced pressure. Also, as the governor weights assume a more nearly radial direction, the moment of the centrifugal force on them around the fulcrum points is re-These two modifying effects duced.



combined tend to give a valve motion fairly proportional to the speed, whereas with a plain flyball governor the motion is proportional to the square of the speed. In this way it is possible to "override" the governor both when shifting from low into intermediate and when shifting from intermediate into high, with the same accelerator-controlled supplementary governor spring, without excessive strain on the accelerator.

It is hardly necessary to explain the operation of the reversing gear, shown at the right in the sectional view of the transmission. If the pinion carrier O is shifted forward (to the left) to bring its clutch jaws into engagement with similar clutch jaws Q on the rear wall of the transmission housing, the main drive shaft N is rotated in the opposite direction to the intermediary shaft F, with a reduction ratio equal to the ratio of the number of teeth in the internal gear to that in the pinion on the intermediary shaft.

Mr. Hale has built a transmission of this type and equipped a car with it, and the writer enjoyed a demonstration ride in the car. Speed-control of the car is effected as follows: When the accelerator is pressed down for acceleration, the governor-spring pressure is increased, and if the accelerator is not released, the change from first to second gear will occur at 20 m.p.h. and that from second to high, at 40 m.p.h., these change-over speeds being determined by the total spring pressure acting on the governor.

But as it requires less power to maintain a given speed than to accelerate to it, the natural thing to do when a satisfactory speed has been reached, is to

let up on the accelerator to maintain that speed. This "let-up" will reduce the governor spring pressure and allow the governor to act to change the gear ratio at a lower car speed. It thus maintains the proper ratio at all times. The reverse is also true; that is, if maximum acceleration or power is desired, the accelerator is fully depressed and the spring pressure on the governor thereby increased, which results in the return to a lower gear being made at a higher car speed. For instance, if you are traveling up a-hill at 35 m.p.h. and press the accelerator down hard, then the change to second gear will be made at 40 m.p.h., unless the accelerator is relieved.

Likewise, if the accelerator is kept fully depressed and the car slows down to 20 m.p.h., the change to low gear takes place automatically. Then when the load is decreased, as on a hill where the grade eases out, there will be an automatic change back to second gear after 20 m.p.h. is exceeded and back to high gear when 40 m.p.h. is exceeded. But if it is not desired to accelerate so quickly, the natural relieving of the accelerator will lessen the pressure and cause ratio changes to occur at lower speeds. Also, when slowing down with little or no pressure on the accelerator, as on the level or a down grade, the change to a lower gear will take place only at relatively low speeds, as the governor action then is opposed only by the fixed spring pressure, the accelerator-controlled spring not being applied.

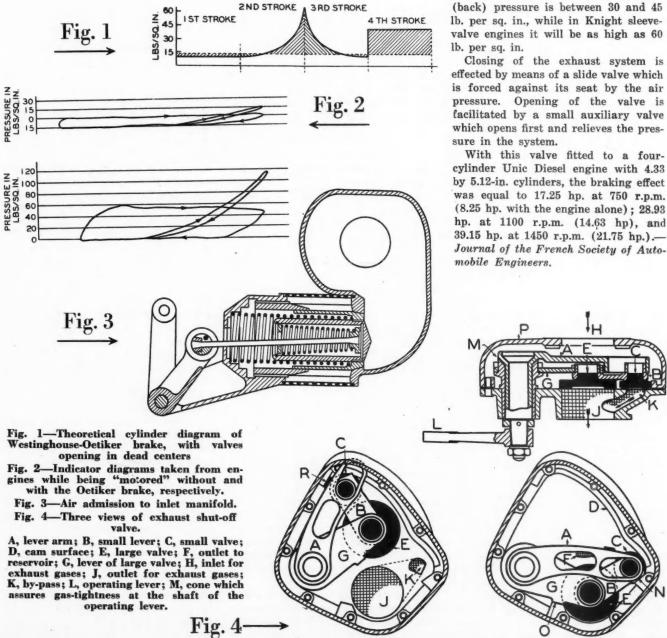
Oetiker Engine Brake

NEW engine brake for vehicles, known as the Oetiker, is being manufactured by the French Westinghouse Co. Engine brakes have been used in the past by Saurer and Panhard, but these brakes involved considerable complication, necessitating axial shifting of the camshaft in order to change the timing. The Oetiker brake is very simple and can be readily applied to a vehicle in service, as practically the only extra part is a shut-off valve in

the exhaust pipe. This pipe may communicate with a closed reservoir or may form such a reservoir itself. An air intake located on the inlet pipe beyond the carburetor is opened when the exhaust pipe is closed. The engine then operates as a four-stroke air compressor.

The operating cycle is illustrated by Figs. 1 and 2. During the first downstroke the cylinder fills with air to a pressure which is equal to the product

of atmospheric pressure and the volumetric efficiency. Since the air does not have to pass through the carburetor throat, the volumetric efficiency will be relatively high, of the order of 80 per cent. During the second stroke the air is compressed and considerable energy is absorbed, but most of this is returned during the third stroke, which is an expansion stroke. It is during the fourth (normally the exhaust) stroke that most of the braking effect is produced. As the exhaust valve is lifted at the beginning of this stroke, the compressed air in the exhaust manifold and reservoir is admitted to the cylinder and the piston has to move upward against this pressure. Owing to the relatively large volume of the manifold and reservoir, the counterpressure remains practically constant throughout the stroke. In most of the installations made the mean effective (back) pressure is between 30 and 45



Data from Scale Models in Wind Tunnel and from Deceleration Tests

agree within usual experimental errors. Stuttgart Technical College undertakes research to determine better correlation.

N the past it has been generally impossible to obtain good agreement between air - resistance - coefficient determinations on scale models in the wind tunnel and the so-called deceleration test; in fact, the latter test usually gave results which were from 30 to 50 per cent higher than those obtained with the first. A research project undertaken with the object of securing better correlation between the results of the two tests was started upon some time ago by the Motor Vehicle and Automotive Engine Department of Stuttgart Technical College, as part of the research program of the Department of Transportation of the German Government. In the past it has been assumed, as a rule, that the wind tunnel tests on small scale models were at fault and bore the whole responsibility for the discrepancies; the Stuttgart investigation has shown that errors are likely to creep into the results of both tests, but when all factors are carefully considered, the results from both tests will check within the usual experimental er-

In the deceleration test the vehicle is brought up to speed, the clutch is disengaged, and the vehicle is allowed to "run out," a curve of distance traveled versus time elapsed being traced by a suitable instrument. In determining the air resistance from the decelerations, account must be taken not only of the actual mass of the vehicle but also of the additional equivalent mass due to rotating parts. As a rule, only the moments of inertia of the road wheels need be determined experimentally, as the moments of inertia of rotating parts of the transmission mechanism can be arrived at by calculation and then "reduced" to the speed of the rear axle.

The air resistance in reality is made up of two items, viz.: the kinetic resistance and the resistance due to skin friction, which latter is dependent on the surface characteristics. As a rule, the skin friction is negligible in comparison with the other resistances.

In evaluating the air resistance coefficient it is necessary to take into account the mass density of the air, for if this is not done and a mean mass density of 0.00238 lb. sec.2/ft.4 is used, the figure obtained for the air-resistance coefficient will vary by as much as 15 per cent between summer and winter conditions. Taking account of the air density, the formula for the air resistance becomes

$$R = k \frac{W}{2 \ a} V^2 A$$
 lb. per sq. ft.(1)

where k is the air-resistance coefficient; W, the weight of one cu. ft. of air; V, the velocity in miles per hour; A, the forwardly projected area of the car, and g the acceleration of gravity. It has been customary in this country to neglect the air-density factor (W/2g). The value of this factor for a normal atmosphere of 0.0764 lb. per cu. ft. is 0.00119, and for a normal atmosphere the coefficient k is therefore 1/0.00119 = 840 times as great as the coefficient c in the usual air resistance formula which neglects the atmospheric density.

One of the possible reasons for the discrepancies between wind-tunnel and deceleration-test results is an incorrect determination of forwardly projected area of the vehicle. Four different methods have been used in obtaining this projected area. One consists in mounting a spotlight some distance behind the vehicle and throwing a shadow of the vehicle on a screen in front of it. The area of the shadow is measured and is reduced in the pro-

portion of the square of the ratio of the distance from the spotlight to the master section of the vehicle to the distance from the spotlight to the screen. By the second method the projected area is taken to be equal to the product of the height and width of the vehicle; by the third, equal to the product of tread and height, and by the fourth, equal to 90 per cent of the product of width and height. The first method evidently is the only correct one, and it is shown that in a particular case the second gives an air-resistance coefficient which is 18.4 per cent small, the third a coefficient 1.1 per cent large, and the fourth, a coefficient of 9.42 per cent small.

Great care is necessary in determining the air velocity, as any error in this measurement is squared in the determination of the air-resistance coefficient. It is also essential to determine the mass density of the air accurately.

It has been generally assumed that the rolling resistance does not change with the speed. This assumption is permissible for vehicles with high-pressure tires, but not for those with low-pressure tires, as the errors become excessive. The rolling resistance increases with the speed, increasing more with a lower inflation pressure. It was found that tests on a dynamometer with drums of 3.28 ft. diameter, with tire pressures of 24 to 25 lb. per sq. in., at € m.p.h. gave about the same rolling resistance (12 to 13 lb. per 1,000), as a good asphalt or concrete pavement.

Another factor which must be considered is the lift of the air pressure on the vehicle, which reduces the pressure of the wheels against the road surface and therefore the rolling resistance. It is pointed out that in order to reduce the lift and to maintain the traction, modern racing cars are usually given an oval shape, so that the air underneath the car can readily flow off on both sides without causing an appreciable lift and impairing the traction.

Another factor which must be considered in evaluating the actual air-resistance coefficient is the direction of the prevailing wind. A contrary wind necessarily increases the air-resistance coefficient, while a tail wind reduces it, but not in the same measure. It is shown that a hardly perceptible wind of 2% m.p.h., if in the direction of travel, may cause an error of 6 to 10 per cent in the air-resistance coefficient arrived at.

Applying the new method of evaluation to a particular vehicle traveling at 110 km. (68.5 miles) per hour, it was found that of the total resistance to motion, 2.03 per cent was due to friction in transmission members, 34.3 per cent to rolling resistance (including 20.4 per cent due to tire-tread flexing and 13.9 per cent to plain rolling resistance), 2.14 per cent to air churning by the wheels, and 62.83 per cent due to air resistance of the car. This gives 101.3 per cent, the explanation being that in traveling over the road the rolling resistance is reduced by the lift of the air-pressure underneath the car by 1.3 per cent.

Emphasis is laid on the difficulty of making accurate models of cars in miniature form. The models may resemble the actual cars in their general form, but the smaller details are difficult to reproduce accurately. Besides, the model will normally be closed at the front, instead of being pervious to the air like a radiator, and there will be no air outlets corresponding to the hood louvers. Furthermore, in the wind tunnel test the model does not move and the "road effect" is therefore missing. This road effect can be simulated by providing a moving belt underneath the model.

In order that wind-tunnel tests may give reliable results, the Reynolds number should be the same in the tunnel tests as in service. Since the scale of the models is usually only one-tenth natural size, this would call for a wind velocity equal to ten times the car velocity, which is impractical. However, as long as the tests are carried out at a Reynolds number which is not critical, the number has little effect on the air-resistance coefficient.

To determine the effects of various experimental factors on the air-re-

sistance coefficient, wind-tunnel tests were made under different conditions. For an exact 1:10 scale model of the car when tested over a moving belt in the wind tunnel, the air-resistance coefficient k (for use in the equation given in the early part of this article) was found to be 1.16, and for the sake of comparison this was given a valuation of 1.000. With a standard atmosphere weighing 0.0764 lb. per cu. ft., this corresponds to a coefficient c = 0.00138 in the simplified air-resistance formula $R = cV^{2}A$. A simplified model having no window recesses gave a mean comparative value of 0.925 when tested first in the free air stream and then with a board representing the road, under it. An exteriorly similar model without air flow through the radiator gave a comparative value of 0.981 for these two sets. The model was rebuilt by removing the forward portion and replacing it by a portion which was an exact duplicate of the radiator shell and the hood, inclusive of the hood louvers, the radiator core being represented by a wire screen, so that the model was to all intents and purposes an exact replica of the actual vehicle. With the wire screen covered, corresponding to closed radiator shutters, the test over the stationary board gave a comparative value for the airresistance coefficient of 1.010 and with the radiator opened a value of 1.030 was obtained. This model was then put together with another similar one, wheel to wheel, and the combination tested in the wind tunnel, which gave a comparative air-resistance coefficient of 1.010.

Opening the radiator changed the air-resistance coefficient by 2 to 3 per cent. To determine the effect of the Reynolds number on the air-resistance coefficient, a model was made to a scale of 1:5. The comparative air-resistance coefficient with this model was 0.955 when suspended freely in the air streams and when tested over the sta-

tionary board, and 0.954 when tested over the moving belt.

Deceleration tests with the same type of vehicle gave the following results: Neglecting the lift of the air pressure under the car, the air-resistance coefficient was found to be 1.13 for the closed radiator and 1.25 for the open radiator, so that the comparative values were 0.972 and 1.075 respectively. The difference between open and closed radiator shutters therefore was of the order of 10 per cent in the full-scale tests, while in the model tests it was only 2 to 3 per cent. For this reason it seems desirable to obtain the airresistance coefficients in both model and full-scale tests with both open and closed radiator shutters, and to compare them with each other. In the model test over a running belt the coefficient was found to be 1.133 (for English units), while the deceleration tests gave 1.128, that is, practically the same value.

If the test results are evaluated in accordance with some recent publications, that is, if in the general formula the reduced masses of the rotating transmission parts are added without considering the friction of the transmission elements, the air-churning effect of the wheels, and the increase in the rolling and the tread-flexing losses with speed, the air-resistance coefficient is found to be 1.593, which corresponds to the comparative figure 1.37, and if in addition the test results are evaluated in accordance with the general formula, an air-resistance coefficient 1.54 is arrived at, corresponding to a comparative value of 1.32.

It will thus be seen that in general the results of wind-tunnel and deceleration tests agree quite satisfactorily if the air-resistance coefficient is evaluated from the observation data of the deceleration tests by the method which has been developed in the Motor Vehicle and Automotive Engine Department of Stuttgart Technical College.—A.T.Z.

Flexible Power Supply

(Continued from page 647)

Note: These are rated 500 amp. capacity.

Complementing the bus duct power lines, there are two systems—one for each building—of the Bull-Dog Trol-E-Duct, for the high-cycle portable tool lines. Each building has its own motorgenerator equipment for producing the special high-frequency current supply.

At the present time, the press shop has only one system consisting of a 240-ft. section of Trol-E-Duct which serves the radiator shell and fender metal finishing lines. The main building features a number of sizable Trol-E-Duct lines serving various assembly functions as follows:

In all, the power distributing system in the DeSoto plant represents one of the most outstanding examples of the modern way of providing flexible power for machinery drives and assembly line tools, with the greatest efficiency known to the art.

Just Among urselves

New York Show Opens With Enthusiasm

A LL of the old magic, the perennial glamour, was present as Alfred Reeves, general manager of the Automobile Manufacturers Association, waved his hand to open the thirty-eighth annual automobile show in New York. It was an auspicious day. Clouds over Wall Street lightened a little with the announcement of a dollar dividend on big steel's common—the first in more than five years—and the reception of an extremely interesting General Motors report.

Early attendance at the show was disappointing but not discouraging when it is recalled that last year's mid-week opening came on Armistice Day, traditionally a day in New York on which people go places to see things. Factory executives at listening posts on the floor were inclined to discount local reaction to the show and the cars, because of undue local weight placed on the tumbling stock prices of the last few weeks.

General Motors officials seemed uniformly satisfied with results of their preview at the Waldorf and the Chrysler salon and Ford previews were also doing well during early hours.

Another Good Year Expected

PRODUCTION of five million motor vehicles this year will probably be followed by a year which approximates this figure within 5 per cent, according to most executives reached for comment. That the 1938 estimate is something more than parrot-talk or wishful thinking is demonstrated by the early orders of one volume producer and a number of the independents who are actually in production volume on 1938 models. In these cases advance orders are reported "satisfactory," which word in interpreted to mean

"within 5 per cent of the same time last year" by most of the people we have talked to.

Straight Talk From the Top

THERE is noted a refreshing solidity about most of the "statements" which are being given out orally by executives. Elsewhere in this issue is reported a speech in Massachusetts by W. S. Knudsen which demonstrates what we mean—plain statement of opinion on important questions. A press breakfast brought similar straight talk from Ford's W. C. Cowling, who sturdily expounded the intention of the Ford organization to work out its own destiny in the face of pressure from any side.

A luncheon given by Willys was a rather jubilant occasion. Ward Canaday, chairman, and Doctor Wilson, president, recalled with elation that beginning with a hand made car at last year's show the organization had produced nearly 75,000 cars up to show time this year. Willys begins the new season with 3000 dealers and the hope of selling 125,000 cars.

Automobile Personalities

As in the past years, a great many cars were first announced to the public through the Saturday Evening Post. Always alert to public interest in the industry, the Post, as you recall has recently printed a remarkable sketch of W. S. Knudsen, and Walter P. Chrysler's "Story of an American Working Man." Unusual interest attaches, therefore, to the Post's choice of automotive biography for its fat show-week issue. The subject is J. D. Mooney, GM's export vice-president.

Exports took a terrible licking during the depression but reaches

this year for new records—therefore the story of Jim Mooney is the story of a terrific upswing in recent years. It is the story, too, of a man who predicted years ago that the nations of the world would be at each others throats if they did not adjust their tariff and exchange difficulties for a freer flow of foreign trade.

It's the story of a remarkable personality, whose responsibilities in General Motors have been broadening with the fact that the GM export division probably enjoys the second largest dollar volume among the automotive divisions in the corporation. Because of the peculiar opportunity of its appearance, we suggest reading and remembering it. The author, by the way, is Charles Wertenbaker, who did the Knudsen job a few months ago.

SAE Dinner is a Real "Get Together"

THIS was being written, necessarily, during the first two days of the New York show and many events of importance were still to come as we went to press, but success of some of them cast long beams in advance. For instance, reservations for the S.A.E.'s Annual Dinner were far in advance of any time in the brilliant history of this event. Besides its own right to a place in the sun, the dinner has inherited much of the character of dinners formerly given by the Automobile Manufacturers Association. In other words, it is the one time during the week when representatives of all branches of the industry, all organizations, can get together in one place.

Industry Watching Detroit Elections

CONSIDERABLE interest is attached to the forthcoming municipal elections in Detroit, where the C.I.O. has its own candidate for the mayorality in the field. A reputable straw vote places the odds against his election at two to one. But what the effects on the automobile industry might be if a C.I.O. men controlled the city's departmental appointments is something we prefer not to think about.—H. H.

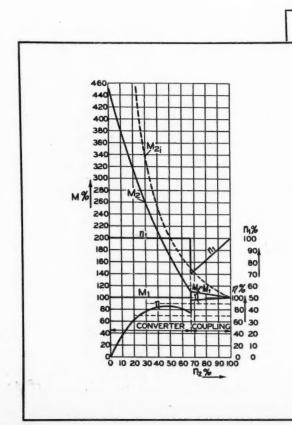
Voith Turbo-Drive

N hydraulic drive for heavy motor vehicles and railcars, developed by the firm of J. M. Voith of Heidenheim, Germany, partly in collaboration with the Austrian Daimler Company, comprises both an hydraulic coupling and an hydraulic torque converter. The driving members of both of these units are rigidly secured to the driving shaft and are therefore driven directly from the engine, both rotating at the same speed as long as the engine is in operation. The driven members of both units also are rigidly connected together, and power is taken off at the same end at which it enters (the left end in the sectional view). While getting up speed and when ascending steep grades, the power is transmitted through the converter, while under

other conditions it is taken through the coupling. The change-over from converter drive to drive through the coupling, and vice versa, is made by emptying one fluid circuit and filling the other, by means of the control pump, which latter is driven from the drive shaft through bevel gearing. With the converter an efficiency of 82-85 per cent is obtained under the most favorable conditions of operation, and with the coupling, between 98 and 99 per cent. One advantage of a drive of this type is that it can be used also for braking purposes, thus relieving the friction brakes on long descents. To produce a braking effect with these units, the

mechanical reversing gear, which must be used in conjunction with them, is set in the reverse position, and with the engine throttled down to the position of equilibrium it will then hold the vehicle at a standstill on a down grade. If the throttle is closed slightly more it will allow the vehicle to roll down grade slowly, while with the throttle opened further it will bring the vehicle to a stop again and even cause it to run backward up hill. Oil is used as the cooling medium through which the heat generated by braking is dissipated to the atmosphere.

Fig. 1 shows the Voith turbo-drive in section and Fig. 2 shows its characteristics. In the chart, M_1 is the driving torque, M_2 , the driven torque; M_2 , the ideal driven torque corresponding to an efficiency of transmission of 100 per cent; n_1 , the r.p.m. of the driven member; n_2 , the r.p.m. of the driven member and n_2 , the efficiency.



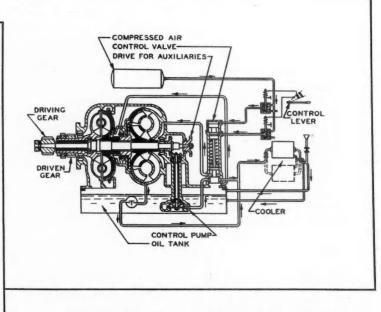
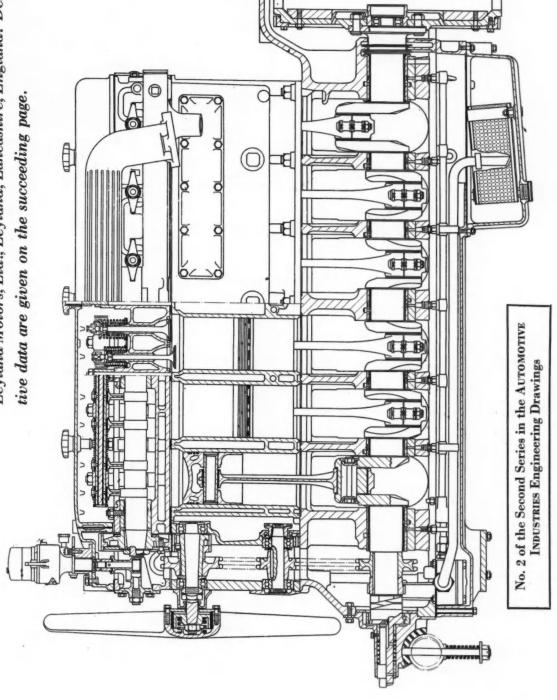


Fig. 1—(above) A sectional view of the Voith turbodrive designed for heavy motor vehicles and railcars.

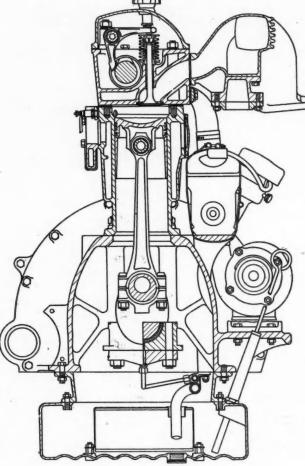
Fig. 2—(left) In this chart the characteristics of the mechanism.

LEYLAND.

 six cylinder bus and truck gasoline engine manufactured by Leyland Motors, Ltd., Leyland, Lancashire, England. Descrip-



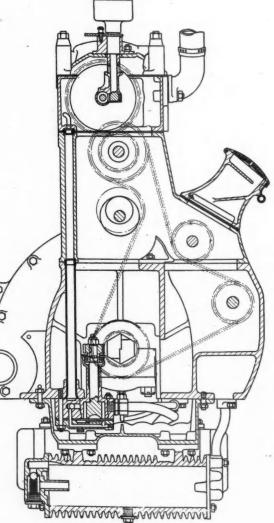
LEYLAND...



Other elements of the engine include: pressure lubrication by duplex gear pump; C. A. V.-Bosch magneto ignition, automatic and manual control; 46 mm. "self-start" Solex carburetor with hot-spot; pump water circulation through cylinder head, thermo-syphon through block; "Still" type radiator; gear driven fan with friction clutch; anti-kick device on hand starting crank. A suction-operated governor arranged to cut out at 2400 r.p.m. is optional.

This six-cylinder gasoline engine has a 4½-in. bore and a 5½-in. stroke, making the total piston displacement 468.1 cu. in. It develops 96 b. hp. at 2200 r.p.m. Maximum torque rating is 325 lb.-ft. at 800 r.p.m.

Seven bearings, with total bearing area of 43 sq. in., support the nickel-steel crankshaft. Stellited seats for the exhaust valves are screwed into the cast-iron cylinder head. The cylinder block is made of chromium iron. Connecting rods are of steel, with big ends white-metalled direct. Aluminum pistons carry four rings, three hardened compression rings and one slotted oil scraper ring. The crankcase of magnesium alloy is carried 4 in. below the crankshaft center.





Production Lines

Power plant for Buick cars for 1938 are here shown rolling off the engine assembly line in Flint.

Cleans Fender

How one thing adds up with another to achieve a plus feature is beautifully illustrated on the new Buicks. You will learn that Buick put a lot of thought into the development of "silent zone" body mounting in which the body bolts are located at nodal points only, said nodes being discovered by some clever work with the oscillograph. Anyhow, on the '38 chassis the rear frame ends are sections of maximum excitation and they are permitted to behave as they will, having no contact with the body at those points. Because the frame ends move, it was difficult to find a means of mounting the gas tank filler in the rear fender, in the conventional manner. So Buick engineers divorced the filler from the fender. You'll find it by lifting a cute, neatly fitting door which fairs in to the fender lines and gives Buick the cleanest fender lines to be found anywhere. Which all adds up to the good.

Racing Stuff

By the looks of it, racing will have some surprises next year. When you consider that Harry Miller is starting off under the best possible conditions on some new designs; and Dave Evans working independently also under favorable circumstances—you can see why we think there are big doings in the offing. Harry Miller is putting up at the Gulf laboratories at Harmarville, Pa., a suburb of Pittsburgh, where the Gulf people have obligingly

built Harry a new building with experimental machine shops, laboratory facilities, drafting room, and what not. Dave Evans isn't talking, at this time. But we suspect that he has some mighty good backing and enough dough to do a good job. Don't be surprised if either Harry or Dave or both have something tricky up their sleeves for the '38 running at Roosevelt Field.

Hoary Catalyst

Believe it or not (paging Ripley) chewing tobacco appears to be one of the vital catalysts in certain important industrial processes. The latest report we have, and it comes from a reliable eye witness, has it that in a certain plant hereabouts a very good old-time machinist uses his cud to improve the surface finish on special machined models. It is his belief, and practiced for ever so many years, that the good old plug is better for his special jobs than any cutting fluid. You can believe it or not, but it seems to be a fact. Now the potency and universality of the "cud" method is not confined to metal cutting alone. We recall that in the early days of United Chromium Corp., when they were contacting various electroplating shops, they, too, encountered the old plugs and had a hard time weaning the foremen of the habit. It seems that certain of the old timers held that chewing tobacco expertly shot into the chromium plating bath had the infallible virtue of producing a good finish. We contribute these random studies to the lore of the trade.

For Coasting

One of the important producers of oilfield machinery is grooming a novel braking device for trucks and buses. It's an hydraulic pump or fluid flywheel, using water, designed as a compact unit for mounting on the rear of the transmission. The Hydromatic brake, as it will be called, will be new as automotive equipment but has given remarkable service as a brake on heavyduty oil drilling machinery. This unit does not supplant the regular brake equipment nor is it intended for use on heavy-duty equipment anywhere except in hilly or mountainous country. However, it will relieve the regular brake equipment of all the burden of negotiating heavy grades with complete safety. It may be used at will for making an emergency stop on a grade but more generally for producing a safe coasting speed.

Improves Metal

Mixed tendencies are found in the development of front end sheet metal. On the one hand, certain makes that had alligator hoods last year have returned to the former practice of hinging at the center. This materially simplifies the problem of forming and fitting. On the other hand, there are those who embrace the alligator hood idea for the first time this year. They have a good reason for so doing. The point is that the alligator hood permits the development of warped surfaces which are essential to a certain design form. And such uniformity of contour is possible only with the alligator hood.

Looks Longer

Never has there been a better life-sized illustration of the psychological effect of lines than in the case of several of the '38 cars. When you look at them you may notice that the bright chromium-plated body molding has been moved down from the window sill level to the door handle line. You may not be conscious of relocation but very definitely you get the impression of lower lines and increased body length.

—J. G.

Assails Capital Curb

(Continued from page 630)

the reasons for the present situation. "What are the remedies for the present state of affairs?

"First, to restore the confidence of the investing public, the government should not insist that a corporation, which is in debt, without sufficient capital to operate safely otherwise, must pay out all of its earnings in dividends.

Second, it should be made possible for banks to lend money to corpora-tions, with the knowledge that, as the corporations earn money, the indebtedness will be reduced, and it will not be necessary to pay out all earnings in

"Third, the capital gains tax should be changed so that if a person loses money one year and makes a profit the next year, he can at least deduct his

losses for a few years.

"The undistributed surplus profits tax is not hurting the big companies with plenty of cash reserves, but it is hurting the expanding business, the new business, and it hurts every little fellow in business. It protects the inheritor of great wealth, as he would otherwise have to pay out more of his share, but it does not protect the little fellow who is trying to make a nest egg.

"Why shouldn't investors lose confidence when, in addition to the ordinary risk of business that they must run, they are faced with foolish tax laws which threaten to insure the eventual bankruptcy of their ventures?

"Until these things are remedied, I can see no permanently favorable

business prospect ahead.

"There is a tremendous latent consumer demand. We need more houses, we need more good roads, we need more manufacturing facilities, but we can't have them with the constant labor agitation which has induced, directly or indirectly, the current strike on the part of both big and little capital.

"Confidence has to be restored in the capital markets before it will be possible to have the expansion in all lines of business necessary to replace normal business mortalities."

Books

(Continued from page 639)

Pennsylvania State College, State College,

This bulletin gives a full account of an extended study on the penetration of sprays such as used in Diesel engines, atomizers, paint sprayers, etc., the emphasis being on Diesel fuel sprayers. The penetration of the spray tip during small consecutive intervals was determined by a sensitive electric circuit. The time required for the spray for various depths of penetration was determined by a "timed" contact in series with the spray contact. Data on the times required to achieve a num-

ber of different penetrations are given for an oil having a viscosity of 45 Saybolt seconds, injected under a pressure of 4000 lb. per sq. in. into air at 15 times atmospheric density through a nozzle with a 0.0135 by 0.027 in. orifice, and equations are given for the penetration for other conditions of injection pressure, air density and nozzle-orifice

The principal conclusions drawn from this investigation are that the initial velocity of the spray may be found from the equation $0.95\ \lor 2$ g h, where h is the pressure head of the oil injected; that the air resistance is proportional to the square of the oil velocity and to the first power of the air density, and independent of the orifice diameter; and that the air resistance decreases with increasing oil viscosity but is not affected by normal changes in the specific gravity. By a simple graphical method described in the bulletin, the penetration can be determined for any combination of injection pressure, chamber air density, orifice diameter, and oil viscosity.

Symposium on Lubricants (held at the Chicago Regional Meeting of the American Society for Testing Materials.) Philadelphia, Pa., published by the Society.

The papers and discussions comprising the Symposium on Lubricants (1937) summarize and bring up to date available information on motor oils and their application. The symposium is limited to motor car engine lubricants. Four papers are included, as follows: Engine Deposits, Causes and Effects, W. A. Gruse and C. J. Livingstone; Automotive Bearings: Effect of Design and Composition on Lubrication, by Arthur F. Underwood; Addition Agents for Motor Oils, by George M. Maverick and R. G. Sloane; How to Select a Motor Oil from the Standpoint of the Consumer, by W. S. James.

ASTM Standards on Petroleum Products and Lubricants, prepared by Committee D-2 on Petroleum Products and Lubricants. Published by the American Society for Testing Materials, Philadelphia, Pa.

The 1937 edition of the compilation of "ASTM Standards on Petroleum Products and Lubricants," sponsored each year by Committee D-2, includes in their latest form the 58 test methods which have been standardized, seven specifications and two lists of definitions of terms relating to petroleum and to material for roads and pavements. Two proposed methods, approved for publication as information and for comment, cover unsulfonated residue of plant spray oils and dropping point of lubricating greases and the 1937 D-2 report which is included also details numerous changes in the standards and gives the revised Diesel fuel oil classification.

Manual of Gear Design—Section 3. By Earle Buckingham. 172 pages, 8½ by 11 inches. Published by The Industrial Press, 148 Lafayette St., New York.

Section 3 of the "Manual of Gear Design" contains the formulas and tables required in solving problems in

helical and spiral gears. The term "helical gears" has been applied to parallel-shaft drives, and the term "spiral gears" (in accordance with common usage) to non-parallel non-intersecting

The book begins with definitions of various gear terms and gives the symbols or notation used in the formulas throughout the book. All formulas are accompanied by examples showing their practical application. Time-saving tables constitute another important feature. These tables eliminate calculations either by giving directly the proportions of various combinations of gears and pinions or by giving data representing partial solutions to many kinds of gear problems.

This book not only deals thoroughly with the design of helical and spiral gears, but includes considerable information and data about the cutting of such gears by hobbing, shaping, and milling. Even change-gear calculation is included, as required in connection with milling or hobbing on a machine with or without a differential mechan-

Durability of Automobile Transmission Gears-Corrections

A number of typographical errors occurred in the second instalment of the paper on "Factors Affecting the Durability of Automobile Transmission Gears," by J. O. Almen and J. C. Straub, which appeared in Automotive Industries of October 9.

Page 489, column 3: The equation for

$$N_a = \sqrt{OR^3_{pq} - PR^3_{pp} \times \cos^3\phi} - \sqrt{OR^3_{qq} - PR^3_{qq} \times \cos^3\phi} - (PR_{pp} + PR_{qq}) \sin\phi$$

should read:

$$\begin{array}{c} N_{a} = \sqrt{OR^{2}_{pv} - PR^{2}_{pv} \times \cos^{2}\!\phi +} \\ \sqrt{OR^{2}_{gv} - PR^{2}_{gv} \times \cos^{2}\!\phi -} \\ (PR_{pv} + PR_{gr})\sin\phi \end{array}$$

Page 490, column 3: The equation $\div 8 A_{pv} = R_{pv} \cos \phi$

should read: $A_{pv} = R_{pr} \cos \phi$

Page 492, column 1: "The contracting flank" should read: "The contacting face," etc.

Page 492, column 3: The equation
$$N = 1 - \frac{F}{L} - \frac{F^2}{3L^2}$$
 should read:
$$N = 1 - \frac{F}{L} + \frac{F^2}{3L^2}$$

$$N=1-\frac{F}{L}+\frac{F^2}{3L^2}$$

Page 493, column 2: The equation 1.5 W_{\bullet}

$$S_g = \frac{1.5 \ W_*}{F \times N \times X_g}$$

should read:

$$S_g = \frac{1.5 W_g}{F \times N \times X_g}$$

Also,
$$W_m = \frac{T}{R_r}$$
 should read:

$$W_g = \frac{T}{R_r}$$

